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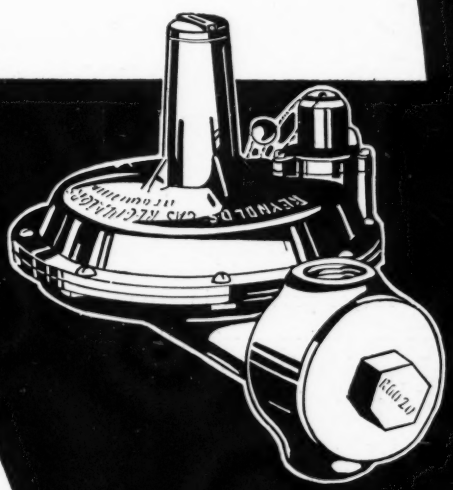

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GAS

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forge the final link...

...in Domestic Gas Service

GAS has quite a history from oil field to oven. It's the story of well drilling and gas testing. It's the romance of a molecule of CH_4 from the compressors, out through the lines to the meter and the regulator. Gas follows all the links in this chain. But it has a single purpose, the supplying of peak heat under rigid regulation.

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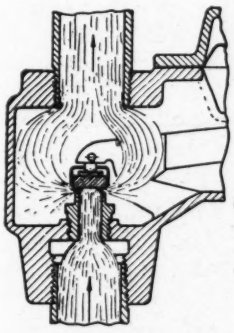
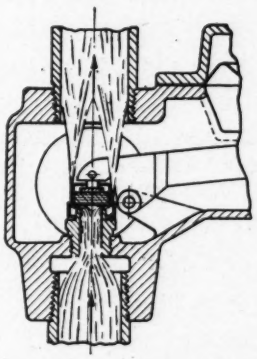


Flow Stream in Valve Chamber without Ejector Ring



Flow Stream in Valve Chamber with Ejector Ring

A simple ejector ring controls the flow of gas as it leaves the orifice formed by the valve and valve seat. By guiding the flow, this ring causes the gas to enter the pipe line system with a minimum of pressure loss and without impingement on the diaphragm. More important, the streamlined shape of the guided flow itself acts as a venturi, and causes pressure to decrease in the outlet side of the valve chamber as the volume increases. This pressure is the actual control pressure under the diaphragm. The larger the volume of flow, the lower the control pressure becomes. The net result of this action is to raise the outlet pressure in the pipe line in direct proportion to the volume requirements of the service.

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GAS

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Twenty-Second Year of Publication

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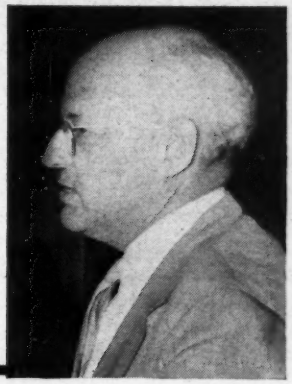
THERMALLY THINKING

By ELLIOTT TAYLOR, Editorial Director



Happy Daze

AS the gas industry foregathers in its 28th annual convention and exhibition in Atlantic City this month, there will be on the surface much of the same old hilarity and the same old noisy optimism that has marked all of these meetings in times past.

The advance publicity fed out by the American Gas Association has prophesied as high as 10,000 in attendance, and we have no doubt that that figure may be reached.

After all, what is there to keep a gas man at home these days? He can't expand his facilities because he can't get materials and equipment; he can't increase his gas load because he can't expand his facilities; he can't sell appliances because the manufacturers of appliances have almost forgotten what sheets and fittings and castings look like, it has been so long since they have been in regular supply. In many instances he is beginning to doubt whether he will even be able to supply an uninterrupted gas service with threats of strikes and walkouts hanging over the utility industry like an all-pervading evil cloud.

His costs of operation are going up daily, almost hourly; yet he knows that any attempt to reconcile gas prices with these new costs would only precipitate a long and costly rate case with his state regulatory commission, in which all of the ragtag and bobtail of political opportunists would appear as intervenors and he would stand a good chance of winding up with a rate reduction ordered instead of the relief that he sought.

In convention he is going to spend a whole afternoon on an employee relations forum. Yet he knows that the old tradition of the gas industry—the tradition that service must go on in spite of any wage and hour differences with his hands—is regarded as nothing more than a quaint old fashioned concept of the bosses by the organizers who have stepped in to liberate his employees from the odious obligations of employee-management cooperation.

If he is a natural-gas man he is going to hear all about the abundance of gas reserves that lie idle, and will probably never be economically used in the great pools of Texas, Oklahoma, and Kansas. But while he views the gaudy picture of what natural gas from Texas can mean in the way of income to Texans, and relief from fuel shortage to the inhabitants and the industries of the Atlantic seaboard states, he will know that natural gas expansion into that area, into the one remaining great market that can absorb its turbulent oversupply, is rapidly becoming a practical political impossibility, with the Federal Power Commission, the coal miners, the railroads and their wolfish board of obstructionists forever blocking the path. If he hears anything at all about the Big Inch lines, and the bids that have been received for their use by potential natural gas carriers, he will also hear on good authority that the disposal of these lines has become a political football that will be booted around the field for months and perhaps for years while the dreamy collectivists try to scheme out some way to hand them over to an oil cooperative that has neither the production capacity nor the native wit to operate them economically.

When the president of the association in his annual address touches on industry solidarity, as he traditionally should, the gas man listening in will be thinking about the bitter and acrimonious newspaper campaign being waged in the fight between the Panhandle Eastern Pipe Line Co. and the Michigan Consolidated Gas Co. over their rival claims to bring more natural gas into the city of Detroit. He will be wondering what the industry or anyone else gains when the public is regaled with advertising that says "Detroiters pay $2 for gas that costs Michigan Consolidated Gas Co. only 38 cents".

Wondering

When Secretary of the Interior Julius Krug talks to the general session about government and business, the gas man listening in will wonder what any cabinet officer in the present administration can know about governing business, considering last month's Wallace fiasco.

Well, there will be plenty of meetings and our gas man won't be able to get around to all of them, what with one thing and another popping up the way it does at a convention.

But certainly he will put in a good many hours in wistful and longing contemplation of the good things in store for him at the gigantic gas appliance exhibit in the Municipal Auditorium. The biggest in history. A hundred and fifty manufacturers spread eagled over 60,000 sq. ft. of floor space. A half million dollars, maybe a million all told, spent on demonstrating the manufacturer's faith and confidence, or maybe only their childish optimism, in the future. There will be gas ranges by the dozens—some of them real, and others expensive hand-made samples produced for display purposes only. There will be furnaces and water heaters and refrigerators all put out under the same conditions. But nothing for sale now—and probably very little for any time in the foreseeable future. For the manufacturers may be optimists but they are not dummies. They know, for instance, that the steel industry upon which they depend for their supplies is already getting set for another strike which its leaders anticipate this fall or winter. They know that they will have

to face new wage demands themselves as the cost of living rises.

Standard Fare

The manufacturers have been feeding their customers on hopes, on optimism, on promises, not because they have wanted to, but because hope and optimism and promises have become their own standard daily fare.

It all adds up to the fact that neither the American gas industry, nor any industry, can afford the luxury of contemplating and discussing and laying plans for the simple solution of its own particular problems. The impasse that blocks the gas industry is no more exclusively a gas industry problem than it is solely a problem of the automotive industry, or of steel or oil or railroads or agriculture. The problem is not primarily one of even labor relations, for the sorry shuffling stooges in the picket lines have no idea what they are there for. All they want is to work at decent wages and to be able to buy something with the money when they get it.

The problem is one of ridding the American economy of the monstrous evil legacy of the leering, shuffling cynic whose dead hand still lays like a blight on our whole economy. It is a problem of ridding government, and particularly the government in Washington, of every bureaucratic control that he set up as an instrument for the perpetuation of his infamous system. It is a problem of purging congress not only of the perpetrators of un-American legislation, but of eliminating from its ranks the wishful dreamy apologists for a misnamed liberalism that they don't even understand.

We hope that the solution will be found in the November elections this year. If it is not, we are of the solemn and studied opinion that the only alternative will be a cataclysmic deflation and depression. The prospect of the latter eventuality, with its attendant suffering and misery on the part of those least able to weather the storm, is not one to be lightly contemplated; yet it would be folly to pretend to ignore its impending imminence.

The 10,000 gas men at Atlantic city can regale themselves with the good times and the good things that the future has in store for them. They may orate in the forums or sing in the bath tub or whistle in the dark. But in our opinion, they have a bigger job to do back home in the November elections than anything that they will be able to accomplish along the boardwalk at Atlantic City from October 7 to 11 inclusive.

Reserves Report

A SNIGNIFICANT step forward in the business of tabulating and publishing vital industry information is represented in the first report of the new Natural Gas Reserves Committee, to be delivered before the meeting of the Natural Gas Department of the American Gas Association in annual industry convention this month.

The need for industry sponsored reserves studies has long been recognized. Over five years ago GAS Magazine observed that the "job is to set up the machinery and delegate the necessary authority whereby an accurate and continuing estimate of the gas reserves of every producing area may be compiled and made available to answer any legitimate governmental, trade or financial inquiry". (GAS—March 1941, p. 17)

In July, 1942, one of the first official acts of E. Holley Poe, upon his appointment to the post of Director of the Natural Gas and Natural Gasoline Division of the Petroleum Industry for War was to set in motion a government and industry cooperation project which resulted in the tabulation of reserves published in 1943, when they were estimated at 110 trillion cu. ft.

Of course there have been numerous estimates made by private geologists, ranging at least as far back as Shaw who estimated 15 trillion cu. ft. in 1919, and coming up to date with those presented before the FPC natural gas investigation by DeGolyer in July of the present year. But despite the assumption of the reasonable accuracy, all of these independent estimates have had one weakness in that they lacked the general acceptability that only industry sponsorship could confer on them.

Reserves Committee

Recognizing this fact, R. H. Hargrove, chairman of the Natural Gas Department of the A.G.A., undertook the formation of a reserves committee, with N. C. McGowan as its chairman. This committee, and the subcommittees working under it, is of necessity large since it was necessary to secure the data pool by pool from every producing area in 24 gas-producing states. After working closely with similar committees of the American Petroleum Institute who gather companion figures on oil reserves, the new A.G.A. committee now comes up with its first annual report.

Understandably enough its chairman has refused to take the edge off his statement by announcing the total figures in advance. But since much of the source data will have been the same, it is to be assumed that the estimate will be reasonably well in line with the DeGolyer figures for this year, or 144 trillion cu. ft. of proved recoverable reserves. (GAS—September 1946, p. 29)

The tedious business of gathering these figures is one that lends itself but little to the flamboyant press releases that mark the progress of more spectacular committee assignments. But it is work of first line importance to the future of natural gas expansion, and as such, it and the pioneer committee that promulgated it, are deserving of full and continuing industry appreciation and support.

False Rumors

The Peoples Gas Light and Coke Co. of Chicago, long recognized throughout the entire gas industry as one of the most promotion and sales-minded utilities in the business, has had to take official cognizance, and issue a denial, of rumors to the effect that the company is discouraging the sale of new gas ranges.

If anything is unthinkable to the well informed, it is that Peoples would discourage the sale of any approved and efficient appliance made to burn gas for any purpose.

This implausible canard probably got its start under cover of a recent announcement made by this gas company to the effect that it would be unable to accpt orders for any new space heating installations until April 30, 1947. This decision was reached with great reluctance, and only because the inability to obtain steel pipe made the addition of new natural gas pipe line capacity impossible.

Since Peoples Gas made its announcement, other utilities have had to refuse or discourage new heating business for the coming season. It might be well for all to be on the alert for rumors set out by competing fuels and to discourage them when and if they do arise as promptly and as simply as did the Chicago company.

Highlights

• Appointment of Walter E. Caine as secretary of the Accounting Section of the American Gas Association has been announced by H. Carl Wolf, managing director, effective Oct. 15. He will continue to head the Bureau of Statistics. His title will be director of Bureau of Statistics, and in addition, secretary, Accounting Section.

• Projects that will utilize 130 MMcf daily of Texas flare gas have been announced by Standlind Oil and Gas Co. Cycling and processing plants are to be built in West Texas, East Texas, and on the Gulf Coast. A gasoline plant is under construction in the Hastings Pool which will convert 30 MMcf daily of flare gas into liquid products.

• The Interstate Oil Compact Commission has been advised that the state of Washington expects to introduce an oil and gas conservation law in the next session of the legislature. Washington has no production at present but the proposed law will be in anticipation of possible discoveries from developments and explorations now under way.

• Of the 4190 wildcat wells drilled in the United States in 1945, 85% were dry holes, 13% produced oil, and 3% produced natural gas.

• Chicago District Pipeline Co., Joliet, Ill., has filed an application with the Federal Power Commission requesting authorization to construct facilities to enable it to receive increased deliveries of gas from Natural Gas Pipeline Co. of America. Such facilities would increase capacity of Chicago District's Crawford line from 220 MMcf per day to 315 MMcf per day. Cost was estimated at $750,000.

• Nearly 900,000 Texans get their living directly from the petroleum industry, figures just compiled by the Texas Mid-Continent Oil and Gas Association show. The wage-earners of this group last year received $560 million in wages and salaries, or virtually 39 cents of every dollar spent by the Texas petroleum industry.

• The Federal Power Commission has received a joint application from the Natural Gas Pipeline Co. of America and Texoma Natural Gas Co., both of Chicago, for permission to extend and enlarge their combined transportation system from which Natural distributes gas at wholesale in Kansas, Nebraska, Iowa, Illinois and Wisconsin. Facilities requested would increase delivery capacity of the system from 349 to 484 MMcf per day.

• Total footage of all wells drilled in oil and gas fields in the United States in 1945 was 90,486,215 ft.—or more than 17,000 miles of hole.

• "Gas range output during 1947 will run between 3 and 4 million units, sufficient to meet any and all demand, and the industry definitely faces a fullscale buyers' market throughout 1948." H. Leigh Whitelaw, managing director of the Gas Appliance Manufacturers Association, quoted in the New York Times Sept. 8.

• An innovation in A.G.A. convention routine has been the invitation extended to the members of the liquefied petroleum gas industry to attend A.G.A. meetings, entertainment features, and the gas appliance exhibit. The Northeastern section of the LP-Gas Association will hold a short meeting at the Hotel President, Atlantic City, Thursday, Oct. 10.

• The editors of gas utility company publications will hold a breakfast meeting, Tuesday, Oct. 8, at 8 A.M. in the Hotel Traymore during the A.G.A. convention. This is the first time the house organ editors have been assembled.

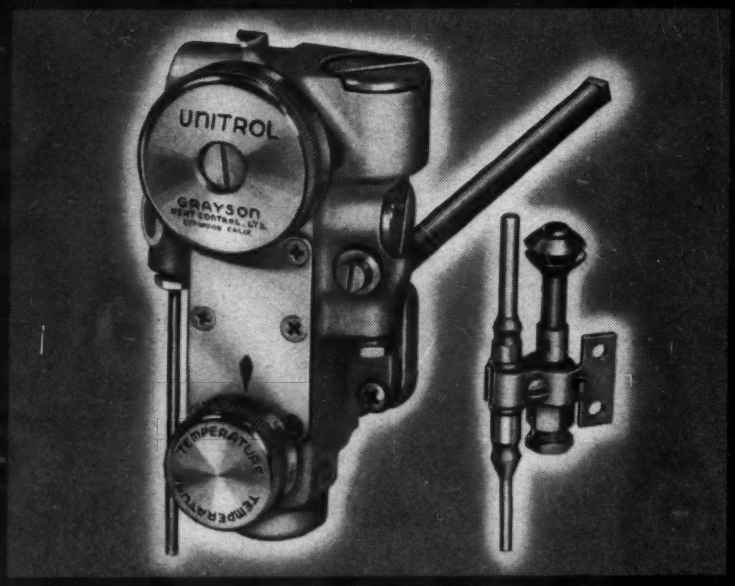
• E. Carl Sorby, chairman of the "CP" Range group of GAMA, predicts 1947 production of "CP" ranges will exceed 2½ million units. Eighteen manufacturers now build gas ranges to "CP" requirements.

• As the gas meter shortage continues to be acute, several big Eastern utilities are exploring the possibility of delivering unmetered service to existing customers on a plan similar to that approved by the California Railroad Commission as an emergency measure for that state.

• The National Association of Railroad and Utility Commissioners has filed an Amicus Curiae Brief with the Supreme Court of Indiana in support of the Public Service Commission of Indiana's attempt to regulate direct sales of Panhandle Eastern Pipe Line Co. gas to industrial customers. If the Indiana Commission wins this case it will establish a precedent whereby all direct sales from pipe lines will be regarded as subject to the jurisdiction of state regulatory bodies.

• At the suggestion of the War Assets Administration, most of the bidders on the Big Inch and Little Inch pipe lines submitted additional substantiating data on their offers. It is now regarded as highly improbable that any bids will be accepted until Congress reconvenes, at which time a clarifying resolution as to Congressional intent may be sought by the disposal agency.

NEW GRAYSON UNITROL "A"



advanced features... 2

Valve can be replaced without removing thermal element from the tank.

GRAYSON
HEAT CONTROL, LTD.
LYNWOOD CALIFORNIA

"Wilful" Payment VS. Forced Collection

By K. L. BOOSEY,

San Jose (Calif.) Division Credit Manager, Pacific Gas and Electric Co.

A method that took the "big stick" out of collection techniques, resulting in a higher percentage of returns with a corresponding decrease in customer shut-offs. By making a "representative" of the collector, the division achieved better relations with the public. This report of a proved practice won honorable mention among papers presented at PCGA's convention.

IT shouldn't be necessary to say that no customer really likes to receive a threat that his utility service will be discontinued unless he pays his bill by a given date. I, for one, do not believe that any utility company or its employees really like to mail out such threats either.

There was a time when we literally papered our sovereign state with these "pay up or else" mail or sticker notices and, although we have all advanced far beyond the discontinuance notice broadside as a general practice, don't you honestly think that there is room for further improvement?

Our company management realized that we were doing ourselves no good by the promiscuous use of discontinuance threats so an honest attempt was made to cut the issuance of them down to a minimum.

Credit History Card

In the division of the company in which the collection practice under discussion is in effect, a credit history card is carried for each customer from date service is commenced to date of closing. In this division, by carefully analyzing each notice sent, the monthly total was cut from 6000 to 3000, but there it was stymied. The credit history card showed notices were sent only to those who should have them and to those where the least injury to public relations was likely to occur. But the cry was still—"Cut down!"

There was no honest way to reduce the number further except by the enie, menie, minie, moe method or by stopping them altogether. So they were stopped!

As it was necessary to feel the way because there were no past experiences on which to build a plan, the cut-over was gradual. One little section of the city of San Jose was used as a guinea pig. One collector was selected and he and a supervisor went to work on the problem of finding a way to get the money in and still send no discontinuance threats.

The Plan

The plan that was finally found to work was to call on the customer at the time he would normally have received a discontinuance notice and explain to him that shut off notices were no longer being sent, but that his account was past due, and further that normally he would have gotten a notice at that time. In other words, instead of sending a *collector after* a shut off notice has been sent, the objective is to send a representative prior to its issuance. The success of a collector is reflected in the satisfactory payment arrangements made for payment of past due bills; and only to the extent that the collector fails is it necessary to issue a shut off notice.

It is explained why it is necessary to read the meters every working day throughout the month and the day *his* meter is read. He is told the date he normally gets the bill, the date the bill is normally past due, and he is asked how he thinks the company should notify him in the future if the account should become past due. The collector calls himself a "representative" and never even refers to the word "collector." It is necessary to digress a moment at this point because 85% of the customers interviewed state that non-payment of the bill was just an oversight and swear by all that's good and holy that "it will never happen again." They rush to get the cash, the check book, or agree to mail the payment in at once. Right here is where real salesmanship begins. We accept the payment, make out the receipt, but never let up on trying to find out what to do in the future. We tell the customer that he might be ill, he might forget again, he might be away or there might be extenuating circumstances and if so how shall we let him know the account is past due. This sticking to the task of finding out is necessary for two reasons:

1. **It impresses upon the customer the importance of paying on time.**
2. **Many customers are just kissing our field man off. In order to keep from having to make arrangements the second time, the collector sells the idea to the customer that for his own benefit he should give us some kind of a statement as to how to handle future transactions.**

In addition to the statement of the amounts due, the field man takes the credit history card with him. The customer's own arrangements for payment are recorded on the credit history card for use in the event the account becomes past due in the future.

Out of 750 persons interviewed only 13 refused to make a commitment regarding future payments.

It should be stated here that the customer is permitted to dictate the terms as to payment date as well as to the method we are to use to notify him; all that is asked is that he stays within reason.

The whole principle has now been outlined. It is:

1. **Instead of sending a notice, represent-**

Results of the New System

Persons interviewed and terms arranged —no notice left		Actual shut-off notices sent same month last year	This year No. shut-off notices sent	Number shut off
March	2209	3467	20	10
April	2377	3543	39	20
May	2518	3707	35	20
June	2123	3256	35	18
July	2073	3000	31	18
August	2298	3383	22	14

tive calls and explains terms, due dates, etc., plus the value of a good credit account.

2. The customer selects the method for future notification and the date he wants to pay.
3. Record is made of the arrangement on the credit history card for future use.
4. Field man emphasizes the fact that he is a "representative," not a "collector".

Now, in subsequent months, if the account becomes past due, the company representative follows the account as pre-arranged with the customer. The account is not given to the field man until after the customer has received a bill containing a reminder notice. Accounts have been so graded that the reminder notice is quite impotent, however. It is surprising to note how many of those that do have to be followed up are apologetic about not having lived up to their own agreement. Briefly, the plan makes the *payment* of the bill the responsibility of the *customer* instead, as with the old method, the *collection* of the bill the responsibility of the *company*.

Results show:

1. We have made a new man out of our collector. He no longer has a feeling that he is a "shut-off man" but instead he is a messenger of good will. He is selling a company product—a better service—something in which he can point out a value to the customer. The result is that the collector is enthusiastic about his job which results in better work. He has a better regard for the company and the department. This is not just an observation but a repetition of statements publicly made by the collectors.
2. Customers no longer can find any complaint with our methods. They learn, and many for the first time, what our credit terms are, but more important, they are given the opportunity of working out their own payment plan so long as they keep within reason.
3. For the first time in history, our public relations auditors this year received no complaints on collections; but, better still, the audit showed more than a few actual compliments on our human handling of distressed accounts.
4. Are customers taking advantage of the system? The question can best be answered by the table.

NOT ONLY honorable mention, but a recommendation "that next year's award committee review its value to the industry after further practical application, for possible recommendation for a higher award," was accorded this paper, presented at the convention in San Francisco, Sept. 10-12.

Mr. Boosey has been with PG&E since September, 1919, when he began work in the San Jose customer records department. He was promoted to department head two years later; in 1930 was named credit department manager.

This table starts at a time when the system had been in effect for a sufficient period to reflect any "cures" that may have been effected.

It can be seen that these cures are consistently around 30%. The plan calls for a constant selling job on the part of the field man: he must continue to try to reduce the number of so-called chronics who wait for him to call.

5. Accounts receivable balance has not increased any appreciable amount.
6. While there has as yet been no charge off to uncollectibles that would include closings accrued under this plan, a careful analysis of unpaid closing bills does not indicate that the charge off will be affected one way or the other.*
7. Ever since this plan has been in operation an average of over 75% have paid as the result of the first call, about one-half paying to the collector and the other half paying in the office within four days. In June, 78.4% paid as a result of first contact. In August 81.5% paid.
8. Because of the very high percentage of payments as a result of the first call, and because of effecting over 30% "cure," there has been no increase in manpower required. It is anticipated that, as field men become better trained salesmen, still more cures will result with the corresponding reduction in man hours required to get in the money.

*Since this paper was prepared, figures have been released on a six months charge off, three months of which included closing bills accrued under this plan. Our loss was .04%, which figure is under company average and our division is third from the lowest in the company's 13 divisions.

At the outset it was stated that we started off with one collector. As soon as he was sold on the idea, the second one was taught, then the third, and so on until the whole division was cut over to this plan.

At first, an hour's discussion was had every morning going over the results of the previous day. An accurate record was kept of accomplishment. The discussion group now meets for an hour once a week—we have always given this much time to "on-the-job training" in our collection department.

Some readers may have gathered that the plan is predicated on a 100% credit history card file. It is not. Practically the same results can be obtained if a credit card is made up when an account first becomes past due. After working in the field, the card, which now has the customer's payment arrangements noted thereon, is filed in the collection office for use should the account become past due in the future.

One more item is this: when a field man can no longer handle a case (that is, when collection on his part is hopeless), he turns it back to the credit office to have a notice sent. Very few are turned back as the field man feels that to turn a case back means he has failed in his job. The notice follows and is worked on the day past expiration regardless of whether the customer is home. No further extension of time is given as the customer will have already been given every opportunity to pay or to get an extension before the notice is sent.

This collection program applies as well with commercial, industrial and agricultural accounts as it does with domestic accounts. The commercial and industrial accounts are treated strictly on a business basis while the policy is to be more concerned with customer relations in dealing with domestic accounts. Crop conditions influence the handling of agricultural accounts.

NEW COKE OVEN PLANT

Indianapolis Installs 47 By-Product Ovens

THE Citizens Gas and Coke Utility on April 5 completed and put into operation a new battery of 47 combination, under-jet, producer gas-fired Wilputte by-product coke ovens. The three-unit producer plant had been completed about six weeks earlier. Thus, another important step has been taken in the expansion and modernization of the gas works and system serving Indianapolis and the surrounding territory in Marion county.

It is interesting to note that the Citizens Gas and Coke Utility is a municipal enterprise, unique in its organization and financing. It was purchased from private interests in 1935 on behalf of the City of Indianapolis with a revenue bond issue, which is a lien against the earnings of the utility and is not an obligation of the tax payers. These bonds are being retired out of current earnings from the gas business.

All matters related to the undertaking are conducted by a Department of Utilities, consisting of a board of self-perpetuating trustees who annually appoint a board of directors. The latter are charged with the management and operation of the utility. Salaries of the trustees are limited by law to $50 annually, those of the directors to $50 monthly. Both trustees and directors are prohibited by law from buying anything from or selling anything to the gas utility. Thus, an arrangement has been created that insures non-political control and an efficient management free of self-interest. Furthermore, the gas company is under the supervision and periodic audit of the State Board of Accounts. Finally, it makes an annual payment to the city of a sum equal to the amount it would pay in taxes as a privately owned corporation.

The first job, back in 1935, was to bring plant and equipment up to date, starting a program of improvement that was designed to meet the city's growing demand for manufactured gas.

PHYSICAL DIMENSIONS OF EACH OVEN

Length—overall	40 ft., 3½ in.
Length between doors	37 ft., 6¾ in.
Height	10 ft., 8 in.
Height to coal line	9 ft., 7 in.
Width—average	17 ft. ⅝ in.
Taper	3 in.
Center to center of ovens	3 ft., 7½ in.
Cubical contents to coal line	527 cu. ft.
Number of heating flues per heating wall	29
Density of coal, as charged	45.5 lbs. per cu. ft.
Weight of coal charged	12 tons

At that time the Prospect St. plant was producing by-product coke oven gas having a specific gravity of .38. The Langsdale Ave. plant, located seven miles away, had both by-product coke ovens and carburetted water gas equipment; but the coke ovens were in very poor repair and had not been operated since 1931. This plant was therefore making straight carburetted water gas, having a specific gravity of .63 and burning characteristics quite different from those of the gas being sent out from Prospect St. Furthermore, the Prospect coke oven plant was operated at a relatively uniform rate, while the water gas plant on Langsdale took up the day-to-day and season-to-season variations in load. Thus at times some customers were served with coke oven gas, at other times with water gas and at still other times with a mixture of the two. Poor service resulted.

15 to 18 MMcf Capacity

To correct this condition new water gas units were constructed at the Prospect St. plant and the entire active production capacity was concentrated there.

The new water gas plant had a daily capacity of 15 to 18 MMcf, and with

its auxiliary equipment brought about a large saving in manufacturing costs.

A part of the water gas produced was used for underfiring the coke ovens, thus releasing all of the coke oven gas for city distribution. When needed, additional water gas was made and mixed with the coke oven gas; but the proportions were such that the changes in specific gravity and combustion characteristics never exceeded the limits of good service.

Industrial Indianapolis continued to grow. An ambitious main extension program was begun in 1936 and increased the gas main mileage from 875 miles to 1185 miles. Service was extended to every corner of Marion county, of which Indianapolis is the hub. In 1935 the gas utility sold an average of 8 MMcf per day and had 77,364 customers; in 1945 it sold an average of 19 MMcf per day and on last March 31 it had 111,672 customers.

To meet this increasing demand various improvements have been necessary. A 12 MMcf waterless holder was completed in March, 1941. In the same year a battery of 41 new by-product coke ovens was constructed. Purification, laboratory and compression equipment was added. Further construction was temporarily halted by the war.

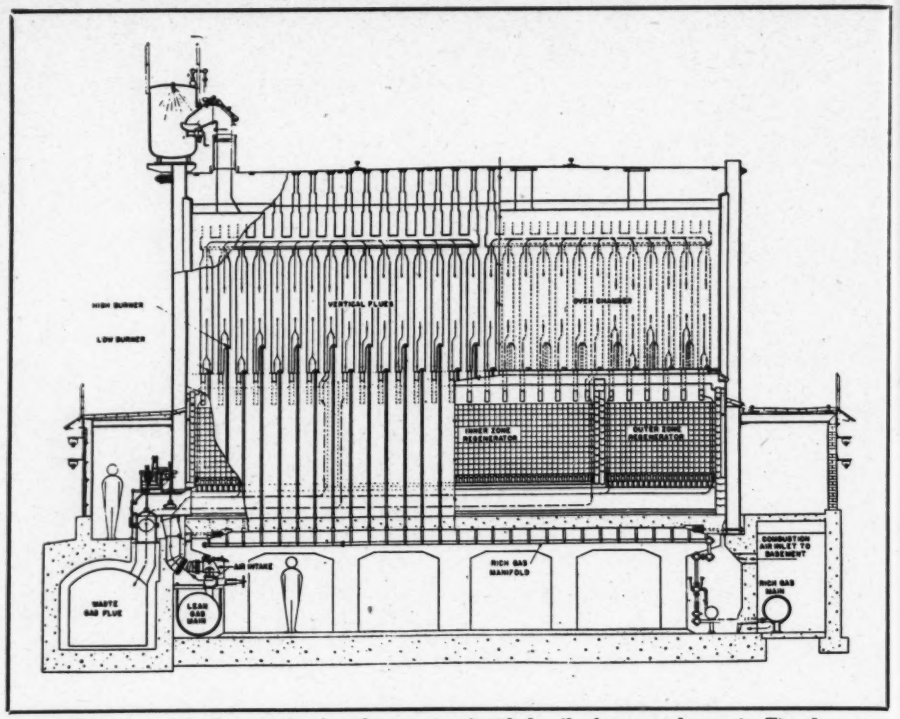
Heavy Demand

The demand for coke and gas during the war period was very heavy; and to meet it the Langsdale Ave. By-Product Coke Oven plant, idle since 1931, was repaired and put into service. From 4 to 6 MMcf of oven gas per day was obtained from it, thus permitting the Langsdale Ave. Water Gas plant to be operated also. The mixed gas sent out was comparable in specific gravity and burning characteristics with that supplied from Prospect St.

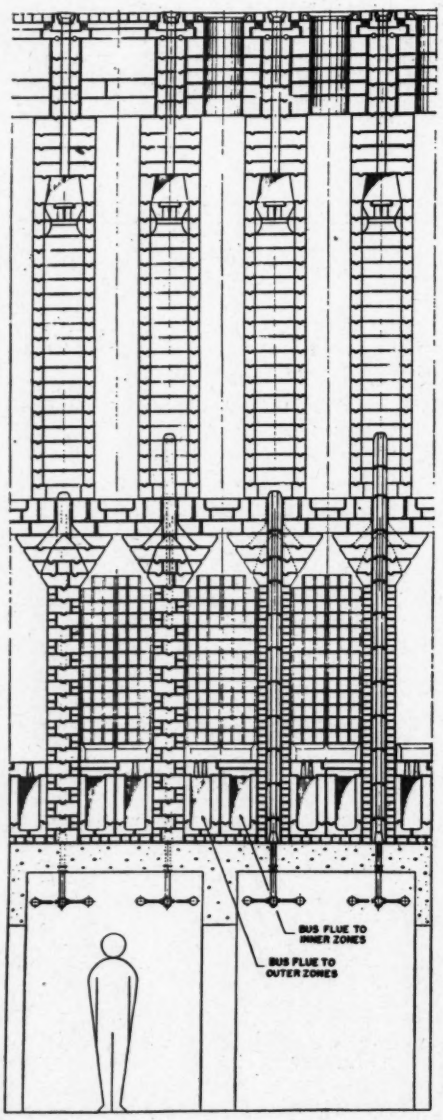
During 1945 it became possible for the management of Citizens Gas and Coke Utility to resume its program of improvements and on March 9, 1945, it announced the letting of a contract to the Wilputte Coke Oven Corp. of New York for the construction of a new battery of 47 by-product coke ovens to replace a battery of 40 ovens built in 1917 and a three-unit producer plant to supply oven underfiring fuel.

Wilputte Ovens

The new battery of ovens comprises 47 Wilputte under-jet, by-product coke ovens, equipped for underfiring with coke oven gas, carburetted water gas, or producer gas. When the ovens are charged with foundry coal mixture and operated on 28 hours coking time, the amount of coal carbonized is 484 net tons per 24 hours; and when charged with domestic coal mixture on 16 hours coking time, the coal carbonized is 846 net tons per 24 hours.



Figs. 2 and 3. Longitudinal and cross sectional detail of ovens shown in Fig. 1.



The under-jet oven was introduced in this country by Wilputte in 1934. The refractory brick structure, comprising the ovens, regenerators, and heating flues is supported on an elevated, reinforced concrete deck. In the basement space between the deck and the oven foundation are located the under-jet system, used for underfiring coke oven gas, or carburetted water gas; the producer gas system, and the combustion air system.

The oven structure itself retains the rugged design characteristics of the early Heinrich Koppers oven. Each oven heating wall is supported along its entire length by a sturdy pillar wall 13 in. thick. Circular rich gas ducts, comprising the under-jet burners, are built integrally into the pillar walls. Alternate under-jet burners extend up to the base of the heating flue, and alternate burners extend higher—to a point about 18 in. above the oven floor. By this means the hot initial zone of combustion is distributed vertically, and overheating of the bottom of the charge is minimized.

When underfiring with producer gas every other regenerator chamber is used for preheating combustion air, and the alternate chambers are used for preheating the producer gas. The changeover from rich gas to producer gas, or vice-versa, is accomplished on

a few minutes notice in response to the varying demand for gas to send out to the distribution system.

A general view of these ovens is shown in Fig. 1, and longitudinal and cross sectional detail in Figs. 2 and 3 respectively.

Producer Plant

The producer gas plant comprises three ten-foot diameter Semet-Solvay steam generating jacket Koller type gas producers, each equipped with automatic weighing fuel charging equipment, automatic revolving grates for continuous removal of ashes, steam turbine driven air blower with automatic blast control, static centrifugal cinder trap, and waste heat boiler. The raw gas is collected in a gas collecting main and delivered to a washer cooler designed for recirculation of scrubbing liquor cooled in an adjacent atmospheric cooling tower. Provision is made for pH control of the circulating liquor to prevent build-up of corrosive elements in the liquor. The cleaned gas is handled by two (one operating, one spare) steam turbine-driven Roots-Connersville exhausters which deliver the gas to a 20 Mcf holder and thence to the ovens. The operation of the exhausters is regulated by an Askania holder position controller, and this in combination with the producer blast controllers provides fully automatic control of the gas-making rate in accordance with the oven heating requirements.

The producer plant has a normal capacity of 16 MMcf of gas per 24 hours with two producers operating and one reserved as a spare. The heating value of the gas varies from 127 to 130 Btu per cu. ft., and the specific gravity is approximately .88.

A general view of the producer plant is shown in Fig. 4, and a close-up view of one of the producers in Fig. 5.

The fuel is pea- and nut-size coke, the mixture averaging 31% pea and 69% nut. Under normal operating conditions 13.4 lb. of this mixture is used per Mcf of gas made.

The plant is approximately self-sustaining with respect to the high pressure steam balance. The waste heat boilers produce sufficient high pressure steam to serve the exhausters and other steam units. The exhaust steam from these units plus the low pressure steam recovered from the producer jackets is sufficient for saturation of the blast with a considerable surplus which is delivered to the low pressure system of the coke plant.

At the present time the producer plant is making all of the heating gas for the new battery of 47 Wilputte ovens, and for a battery of 41 Koppers ovens which were built in 1941, and which were recently equipped by the Wilputte Coke Oven Corp. for underfiring with producer gas.

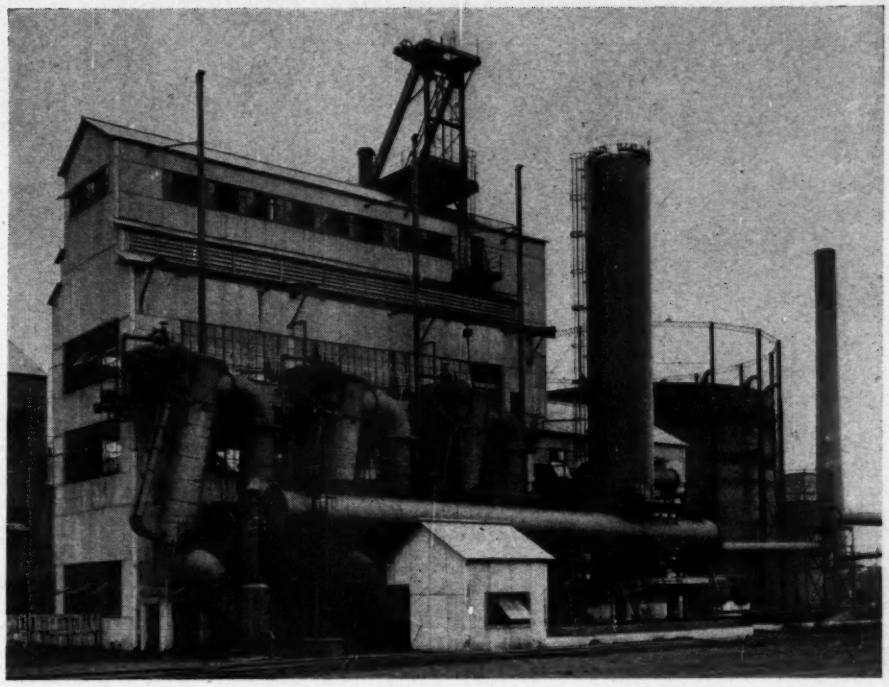


Fig. 4. General view of producer plant.

No major changes in the by-product plant were required with the installation of the new Wilputte coke ovens. This battery replaced the former one and the additional seven ovens did not require an enlargement of the by-product plant.

Demands for gas and coke have reached such proportions that the Citizens Gas and Coke Utility has announced another $2 million improvement program to begin immediately and expected to be completed in 1947. Two additional water gas sets, the latest type and design, capable of producing 15 MMcf of gas, buildings to house them, and additional purification equipment and compressors are to be built and ready.

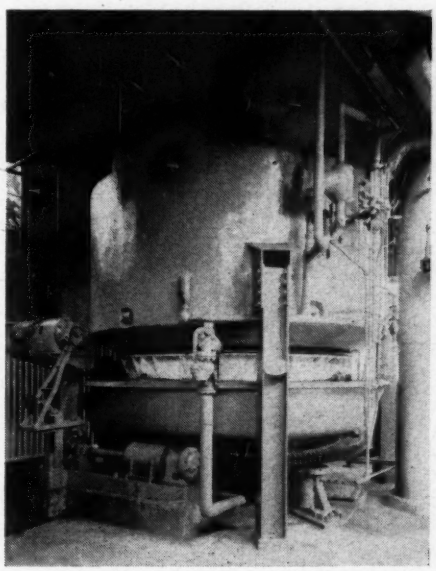


Fig. 5. Close-up view of producer.

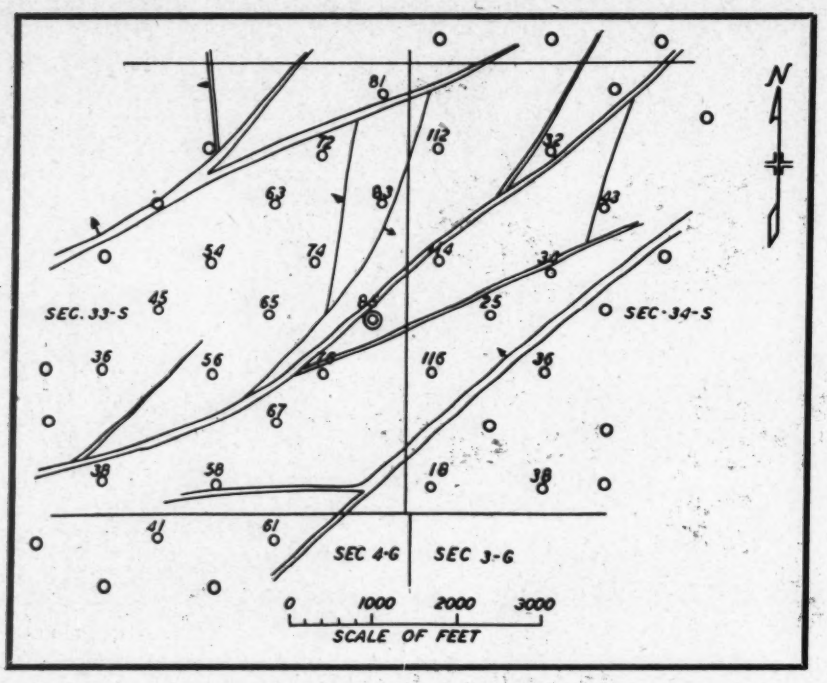
Oil Output Reduction Ordered to Save Gas

AS a preliminary step in attempts to solve the tremendous problem of halting the waste of natural gas in Oklahoma, the Oklahoma Corporation Commission, on Sept. 4, ordered oil production in West Edmond field, reduced from 77,000 to 40,000 bbls. daily, retroactive to Sept. 1.

Wells will be allowed to produce only 61 bbls. of oil daily, reduced from the former allowable of 124 bbls. per well daily. This action was taken after a hearing in which members of the state conservation department admitted that 319,047 Mcf of gas daily was being vented in the field.

Out of the estimated production of 384,597 Mcf daily in August, only 65,550 Mcf of gas was being sold to transmission lines and used for field purposes.

United operation, which would include repressuring measures, is being advanced by state conservation officials as a proposed permanent solution for the problem of conserving gas produced with the crude petroleum in several important Oklahoma oil fields.



Tracing Gas With Helium

By E. M. FROST, JR.

Chemical Engineer, Petroleum and Natural Gas
Bureau of Mines.

Helium has great value to the oil and gas industry as a tracer gas, according to tests just completed in the Elk Hills Field, Naval Petroleum Reserve No. 1, Kern county, California. When used as tracer gas, small percentages of helium are mixed with natural gas pumped into a reservoir for conservation, repressuring, or cycling purposes. Because minute quantities of helium added to natural gases can be detected by analytical methods and accurately determined, the variations of the helium content of gas withdrawn from various parts of a field when helium has been added to the injected gas gives interesting and long-sought data on the movement of injected gas through reservoirs.

THE Bureau of Mines engineers began their studies of the use of helium as a tracer material in gas-injection operations in the Elk Hills oil field, Naval Petroleum Reserve No. 1, in response to a request by the Navy Department for assistance in connection with an expanded oil-production program instituted in that field. This report discusses the bureau's work on the problem of determining the direction and extent of migration of injected gas in the Elk Hills reservoir by the use of helium as a tracer gas.

Field Tests

A preliminary survey was made to determine the initial helium content of the natural gas produced from wells in the Elk Hills field. Portable helium-analysis apparatus[1] brought to the field was capable of detecting helium contents lower than 0.001%. Results often could be checked to 0.0001%.

Following the preliminary survey, a gas-injection well in section 33S was selected for the initial helium gas-tracer tests. *Fig. 1* shows that portion of the Elk Hills field in the vicinity of the selected well. The injection well (85-33S) is identified by a double circle. The double and single lines on *Fig. 1* represent faults established by electric log correlations, drilling records, and bottom-hole pressure surveys. Many of the faults were presumed to be barriers to the migration of gas.

An intensive study was made of the gas from wells in the vicinity of the injection well to establish the initial helium content of gas produced from those wells. The injected gas also was examined for helium content. The helium contents of all these gases were found to average approximately 0.0007%. Occasionally the helium content of the gas samples deviated from this average, but the sustained average helium content of the gas from the various wells did not vary by more than a few ten-thousandths of 1%.

Volume Injected

Approximately 2MMcf of gas per day was injected into the injection well at a pressure of approximately 200 psig.

Gas was injected into two zones, the Sub-Scalez 1 and Sub-Scalez 2, in the Elk Hills field. It was not possible to confine the injected gas to a single zone, as the injection well was open to both zones. The casing in the injection well was perforated at 2760 to 2805 ft. to permit entry of gas into the Sub-Scalez 1 zone, and at 2825 to 2860 ft. to permit entry of gas into the Sub-Scalez 2 zone. The Sub-Scalez 1 zone in the vicinity of the injection well varies in thickness from 20 to 35 ft.; the Sub-Scalez 2 zone is about 20 ft. thick. The porosity of each zone is about 35%. The permeability varies from 100 to 25,000 millidarcys, averaging 2000 to 3000 millidarcys. The connate water content of the reservoir sands is about 20%. The oil-gas contact in the oil zones is not clearly defined. Both oil and gas usually were produced from each well, the oil being pumped through the tubing and the gas being produced through the annulus between the tubing and casing. Some gas was liberated from the oil in the tanks at the surface but was not mixed with casing-head gas in the field.

Helium was brought to the field in motor-transport trailers under a pressure of about 2400 psi. The helium was throttled directly from the trailer into the injection well. Helium was added to the injected gas during two distinct periods. The first addition of helium began on May 25 and was continued until June 27, 1945. Helium was added continuously to the injected gas during this period at an essentially constant rate and in enough quantity

1. Frost, E. M., Jr., Improved Apparatus and Procedure for the Determination of Helium in Natural Gas: Bureau of Mines Report of Investigation 3899.

Reprinted from Bureau of Mines Report of Investigations 3897.

The figure at the top of this page is Fig. 1 as referred to in the text, showing that portion of Elk Hills field in which the selected well was located.

Migration

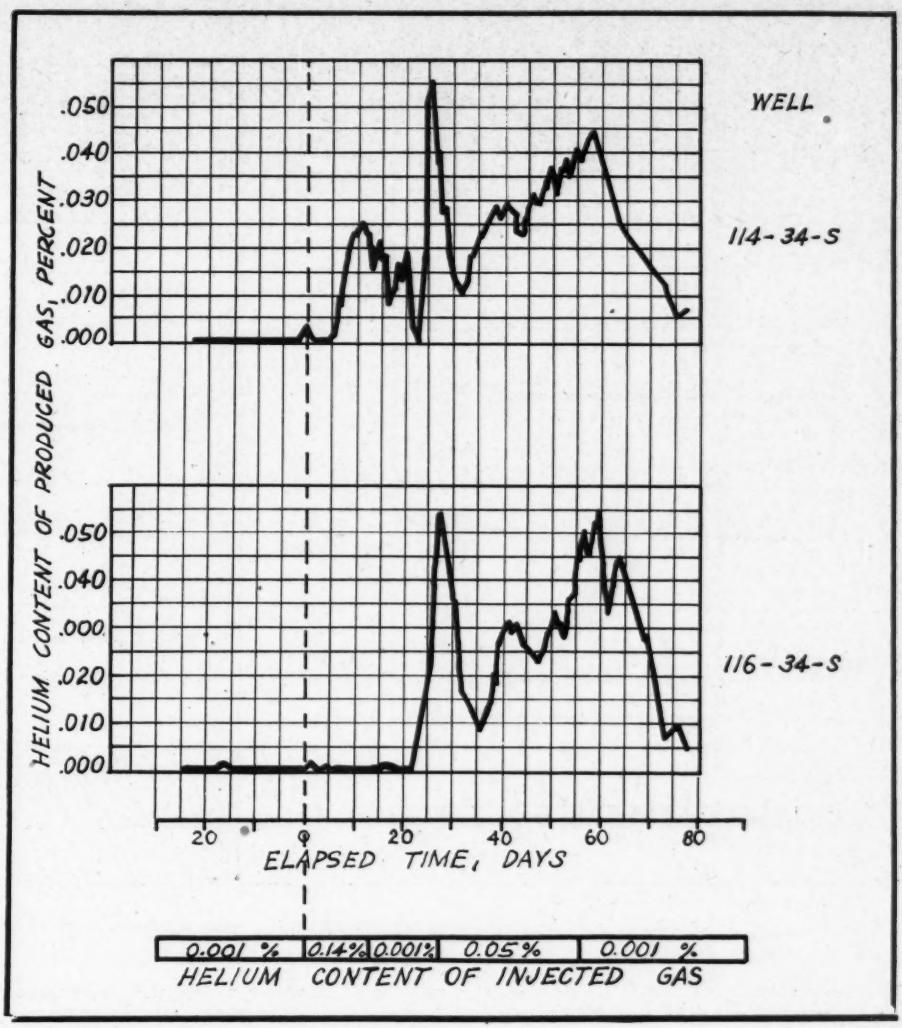


Fig. 2. Daily average helium content of two wells.

to bring the helium content of the injected gas to approximately 0.14%. No helium was added to the injected gas between June 8 and June 21. The second addition of helium to the injected gas was begun on June 21 and was completed on July 20. During this period, helium was added at an essentially constant rate and in enough quantity to raise the helium content of the injected gas to approximately 0.05%. No helium was added after July 20. The program of collecting and analyzing samples of produced gas was carried on until the middle of August, when, as a result of V-J day, sharp curtailment of oil-producing operations in the Naval Petroleum Reserve No. 1 began to take effect, and the Bureau's helium tracer-gas work at Elk Hills was discontinued.

Results of Tests

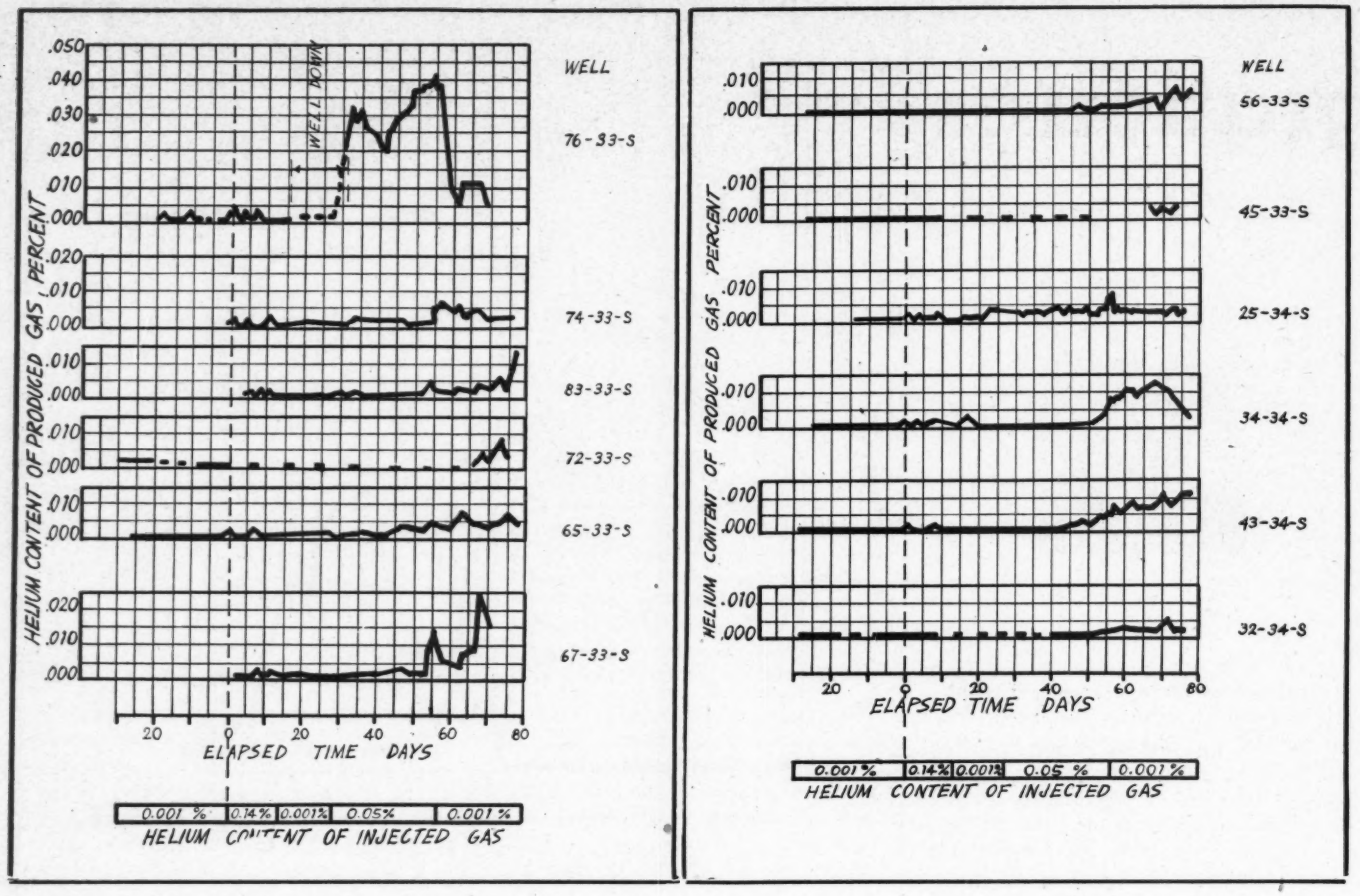
The results obtained in the helium tracer work can be presented best by means of charts showing the daily average helium content of gas produced from each well, plotted against time. These data for gas from wells 114 - 34S and 116 - 34S (see *Fig. 1*) are shown in *Fig. 2*. The time scale on *Fig. 2* is in elapsed days relative to the time of first starting the addition of helium as a tracer to the injected gas. The helium contents of gas produced from various other wells are shown in *Figs. 3, 4, 5 and 6*. The four wells closest to the injection well are wells 114 - 34S, 116 - 34S, 76 - 33S, and 74 - 33S. Data on these wells are shown in *Figs. 2 and 3*. The helium-laden injected gas appeared at well 114 - 34S five days after the injection of helium was begun. It appeared at well 116-34S after 22 days, at well 76-33S after approximately 30 days, and at well 74-33S after approximately 55 days. Although the time of appearance of helium at the last two wells is not definite, there is no doubt about its having reached those wells. Well 76-33S was shut down 14 days for a work - over job, as shown in *Fig. 3*, and when the well again was put on production, helium tracer gas was found to be present in the gas produced. If the wave of helium-laden injected gas appeared at well 76-33S as sharply as it did at wells 114-34S and 116-34S, it probably arrived at well 76-33S 27 or 28 days after starting the injection tests.

The helium-laden injected gas may have appeared at well 74-33S about 35 days after start of the test, according to *Fig. 3*. The increase in helium content of the gas from the well noted at that time, however, did not persist. The helium content decreased and did not again increase until about 55 days later, when the subsequent sustained increase left no doubt but that the helium-laden injected gas had reached well 74-33S.

Time of Arrival Estimated

As helium-laden gas was detected in gas produced from wells near the injection well, additional wells farther from the injection well were selected for regular sampling and analysis. Data collected from these additional wells are shown in *Figs. 5 and 6*. Although the unexpected termination of the work resulted in fragmentary data from these later wells, the data are presented because in many cases positive arrival of helium-laden injected gas is revealed, and in some instances the time of arrival of this gas at the wells may be estimated.

It was impossible to differentiate between results obtained with the first wave of helium-laden injected gas and results obtained with the second wave. The first period of helium injection might have provided all the data necessary to determine the direction and rate of migration of the injected gas,



Figs 3 and 4. Average daily helium content of gas produced from 12 wells, plotted against time.

but an appreciably longer time interval apparently should have been interposed between the two waves to permit differentiation of results obtained with each wave.

Fault Creates Barrier

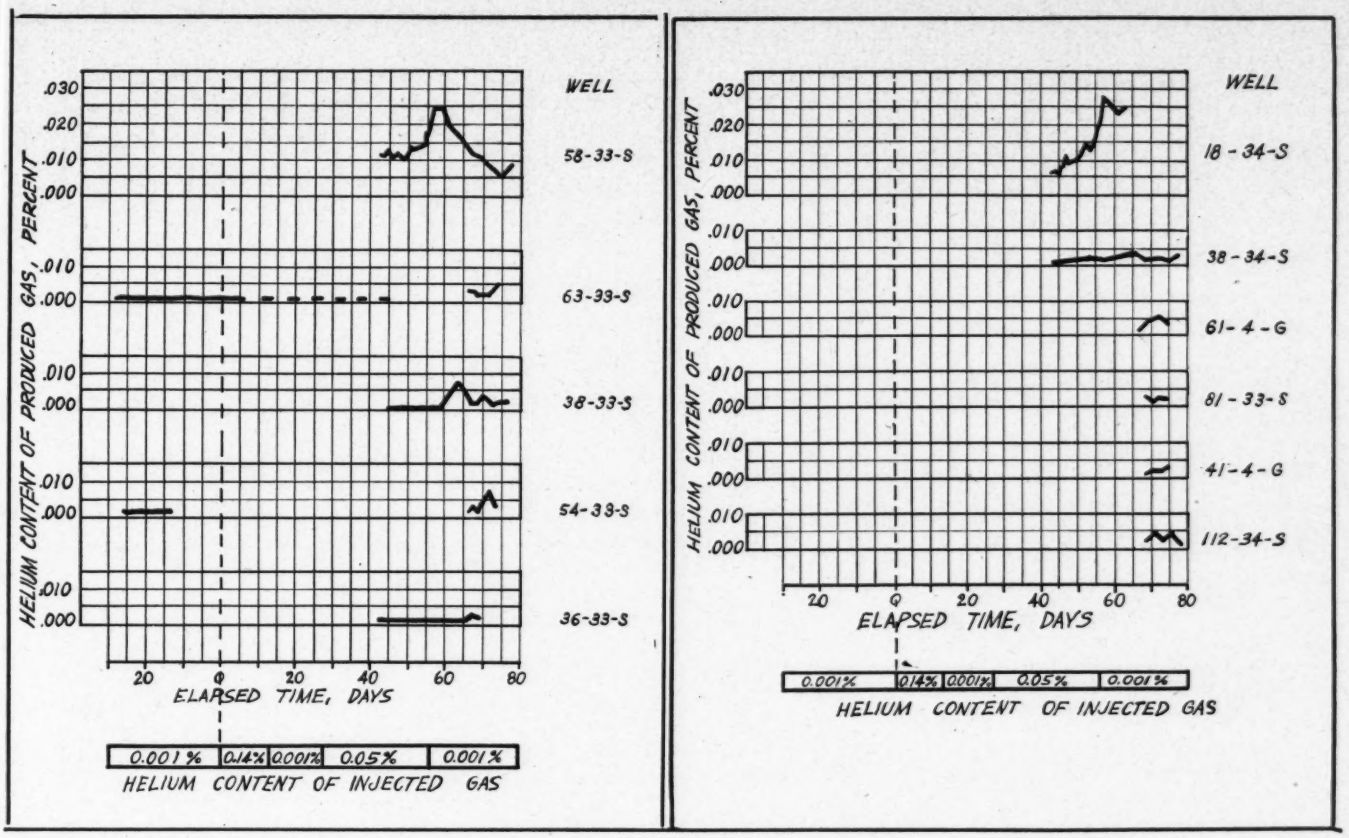
The time of arrival of the helium-laden injected gas at each of the various wells was determined as precisely as possible from an inspection of *Figs. 2 to 6.* From these data, an estimate was made of the distance the gas had traveled from the injection well by the end of 20, 40, 60, and 75 days. These data are plotted in *Fig. 7,* the basic map of *Fig. 7* being identical with *Fig. 1.* The dotted lines of *Fig. 7* show graphically the direction and extent of migration of the helium-laden injected gas at the end of each period. These lines were plotted to the west of the fault near well 36-34S down to the point of juncture of the two faults near the southeast corner of section 33S. Field analyses other than the helium tracer work indicated a barrier in section 34S created by this fault. Well 36-34S was not a producing well under test in the present work, but it yielded support to the probable presence of the barrier. The field analyses supporting the probable presence of the barrier were based on well-head and bottom-hole pressures under shut-in conditions. Wells to the east of the fault, in addition to those shown in *Figs. 1 and 7,* furnished additional data supporting these analyses. The pressures in wells to the east of the fault were materially less than in wells to the west of the fault. Well 36-34S was an injection well taking gas at less than 100-lb. pressure, compared to the pressure of approximately 200 lbs. at well 85-33S. The shut-in well-head pressure of wells to the west of the fault exceeded 200 lbs.

TABLE 1. HELIUM CONTENT OF GAS AND RATE OF PRODUCTION
From Well 114-34S at 2-hr. intervals on June 14 and 15, 1945.

	Time of sampling	Helium content of gas, per cent	Gas-production rate, Mcf per day
June 14	8:30 a.m.	.0081	34
	10:30 a.m.	.0069	40
	12:30 p.m.	.0127	43
	2:30 p.m.	.0212	46
	4:30 p.m.	.0271	45
	6:30 p.m.	.0294	44
	8:30 p.m.	.0246	43
	10:30 p.m.	.0255	42
June 15	8:30 a.m.	.0089	34
	10:30 a.m.	.0077	34
	12:30 p.m.	.0010	31
	2:30 p.m.	.0026	34
	4:30 p.m.	.0005	31

Concept of Fig. 7.

The time of arrival of helium-laden injected gas at wells 18 and 38, section 34S, the relatively sharp arrival at well 18 compared to the more gradual arrival at well 38, and the probable extensive fracturing of the formation at the juncture of the major and minor faults in the southeast corner of section 33S led to the con-



Figs. 5 and 6. Average daily helium content from 11 wells located some distance from injection well.

cept of the lines as drawn in the vicinity of wells 18-34S and 38-34S of *Fig. 7*.

Success Shown

Fig. 7 provides visual evidence of the success obtained in utilizing helium as a tracer gas to follow the movement of injected gases underground in the Elk Hills field.

The low initial helium content of gas produced from wells in the Elk Hills field permitted the utilization of a very small percentage of helium as a tracer in the injected gas. Gases from other fields having higher helium contents may require larger concentrations of helium. Tests now are being planned to correlate more closely the initial helium contents and the percentages of helium which should be added as a tracer. These results will be released promptly after the data are obtained.

The helium content of gas produced from a well was found in many instances to vary in a cyclic manner. Considerable time was spent in the initial survey to determine the magnitude of the variations and the average initial helium contents. The helium content of the gas produced from wells in that portion of the field selected for the described tests was found to average about 0.0007%. The content in the gas from a single well might vary over a period of days from 0.0004% to 0.0012%, and an occasional sample might even vary by a larger per cent. The cycles seemed to be of only a few days' maximum duration, and successive cycles always gave essentially the same average helium content. Numerically, this variation was not great, but on a percentage

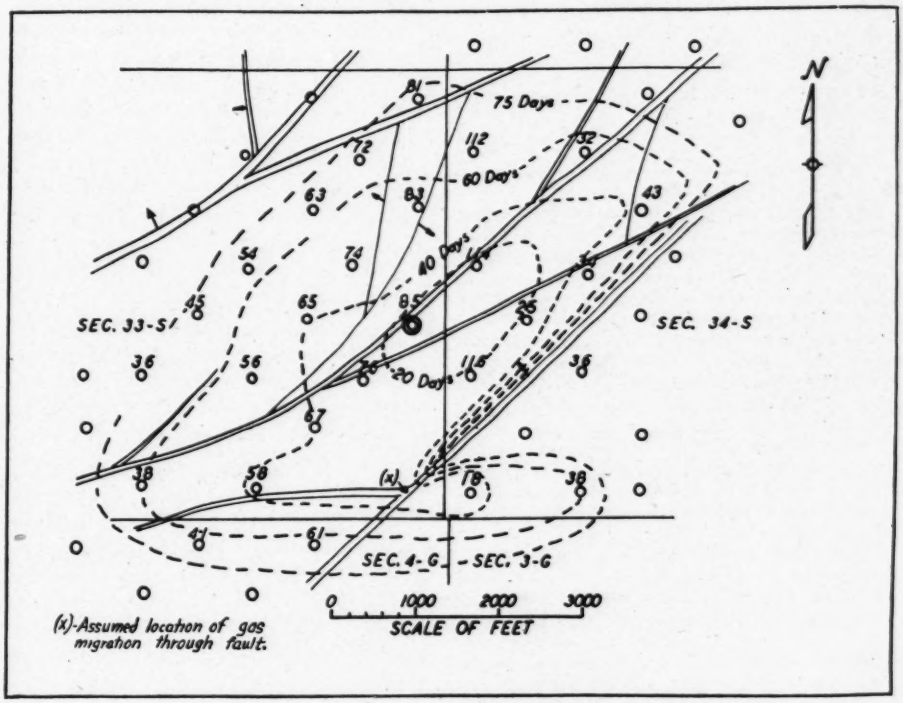


Fig. 7. Direction and speed of helium-laden gas migration.

basis it was definitely appreciable.

The helium content of gas produced from wells varied somewhat depending on the way the wells were handled. Invariably the helium content of the gas drawn from a well increased when a well was shut in, as though the helium was stratifying in the casing. Also, it was noted that the helium content of gas from a well sometimes was affected by changes in the operation of the well pump.

Operation Affected Content

The variations of helium content always remained within narrow numerical limits. The average helium content of gas from one part of the field was not necessarily the same as that of gas from other parts of the field, but again the numerical differences in the sustained average contents were not great. This phenomenon is not new to the bureau. In its search for commercial helium-bearing gas deposits, the Bureau of Mines has analyzed gases from many wells in many fields. Some fields have been under observation for more than 15 years. In many of the fields, adjacent wells do not necessarily have the same helium contents, and no tendency has been noted for the helium content of gases in different parts of the same reservoir to equalize.

Successive Samples Vary

Following the initial addition of helium as a tracer to the injected gas in the Elk Hills, samples were taken several times daily from wells adjacent to the injection well. When helium appeared in those wells, it was noted that the helium content of the gas from successive samples during the day varied appreciably and apparently in a manner similar to that of the variations noted in the preliminary survey. The variations persisted without any indication of settling out. To determine the character of these variations, well 114-34S was sampled and gauged at 2-hour intervals from 8:30 a.m. to 10:30 p.m., June 14, and from 8:30 a.m. to 4:30 p.m., June 15. The helium content and the rate of gas production are shown graphically in *Fig. 8.* The data used in plotting this figure are given in *Table 1.*

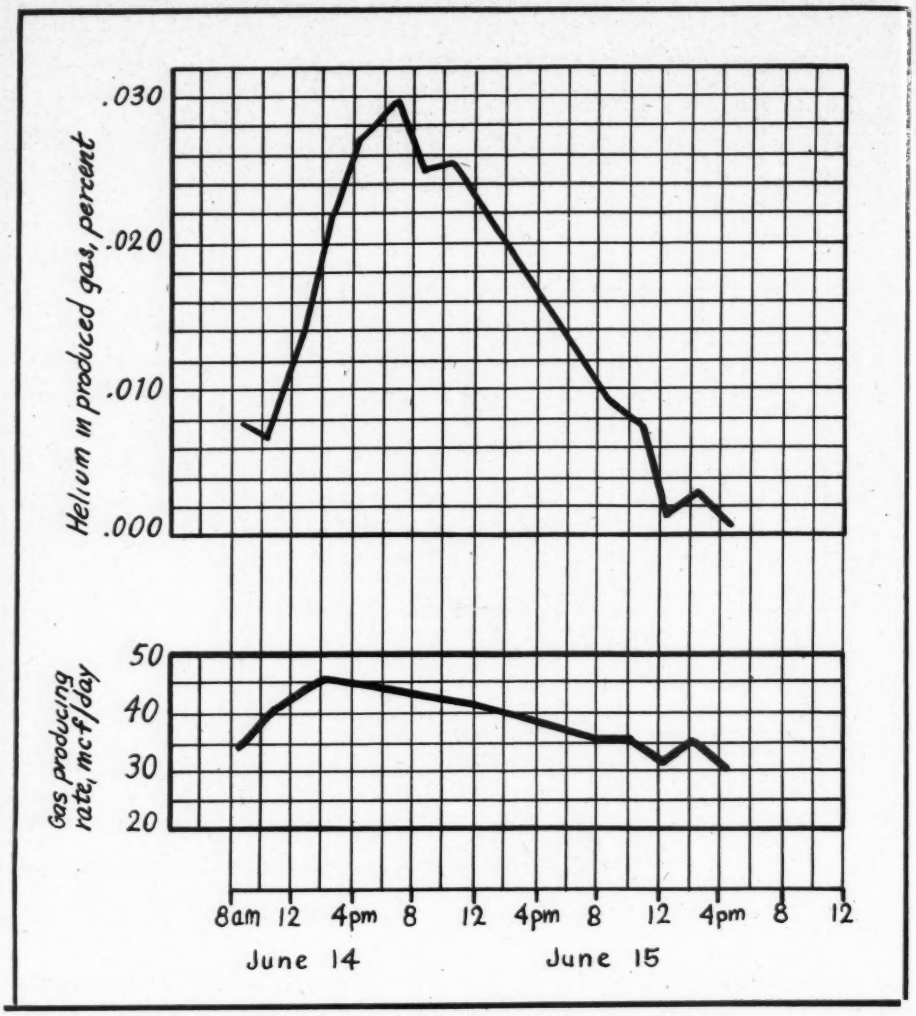


Fig. 8. Helium content of gas and rate of production.

Additional data from well 114-34S are shown in *Fig. 2.* In preparing *Fig. 2,* the daily average helium content was used. June 14th, the first day of the special test, is the 20th day of elapsed time shown in *Fig. 2.*

No data indicating a progressive steady transition from natural gas or non-helium-laden injected gas to helium-laden injected gas was obtained. Accordingly, it was impossible to calculate any sustained or uniformly varying mixture of the two gases coming into the well bore. Bureau engineers are resurveying the data obtained in the Elk Hills field to determine, if possible, the characteristics of the flow of gases through the underground reservoir and into well bores. Additional work in other fields also is contemplated.

ACKNOWLEDGMENTS

The bureau appreciates the cooperation and assistance of Commodore W. G. Greenman, U.S.N., director, and Commander R. W. Walling, U.S.N.R., assistant director, Naval Petroleum and Oil Shale Reserves, Washington, D.C.; Captain H. P. Stolz, U.S. N.R., commanding officer, and Commander F. G. Taves, U.S.N.R., of the Navy's Elk Hills staff. The bureau also appreciates the cooperation and assistance given by V. O. Wankowski, F. C. Tratt, Murray Putnam, Dana Champion, and other personnel of the Standard Oil Co. of California, operators of the Elk Hills field.

R. A. Cattell, chief, and C. C. Anderson, assistant chief, Petroleum and Natural Gas Division; C. W. Seibel, supervising engineer, Bureau of Mines Helium Plants; and H. H. Hinson, petroleum engineer—all of the bureau's staff — furnished valuable advice and assistance during the course of the work. H. C. Miller and G. B. Shea of the bureau's San Francisco office contributed valuable liason work. The writer wishes to express appreciation to all these people for their cooperation and assistance.

MR. FROST has a long and distinguished record with the Bureau of Mines of the Department of the Interior. In 1925, having been graduated from Oklahoma A & M's School of Chemical Engineering, he went to work for the Petroleum and Natural Gas Division, transferring to helium activities the following year. For the past 20 years he has remained with the division, and has directed most of his efforts toward research in helium and natural gas. In 1935 he was assigned to an A.G.A.-Bureau of Mines cooperative program studying the transportation of natural gas. During the war he was assistant to the engineer-in-charge at the Navajo Helium Plant, Shiprock, N. Mex.

Returning to the Amarillo, Texas, office, Mr. Frost was assigned to helium tracer studies. Twice he has been honored with an Award of Excellence from the director of the Department of the Interior; once for his success in natural gas transportation study, more recently for the work reported in this paper.

Claremont Converts To Propane Air

By S. C. McLAUGHLIN,
Manager, Claremont Gas Light Co.
Claremont, N. H.

EVER-INCREASING interest is being manifested in the possibilities of liquefied petroleum gases—especially in the New England and Eastern seaboard states, where a number of utilities are converting, or are contemplating conversion, to propane-air. As a log of results, the accompanying paper provides an interesting report of operations since the changeover from water gas was made. It was originally presented in expanded form at the May meeting of the Operating Division, New England Gas Association, and is published here as further evidence of the propane-air trend as reported by H. Emerson Thomas and Paul E. Peacock in the July issue of GAS ("It will Pay You to Convert to Propane-Air," pp. 32-36.)

THE propane-air gas installation at Claremont serves 1360 meters through 20 miles of distribution mains varying in size from 12-in. cast iron to 2-in. steel pipe. It replaced 525 Btu water gas with 900 Btu propane-air gas. New rates are stated in therms instead of hundred cubic feet. Water gas production was 90 Mcf per day.

The production plant was designed and furnished by the North American Utility and Construction Corporation. Installation was at the old gas works site and existing buildings were used. Equipment consists of one 30,000-gal. storage tank, three inspirator type mixers rated at 10 Mcf of 900 Btu gas per hour each, a 12,000-gal. surge tank, duplicate low pressure distribution governors, one station meter, and one Thermeter. A gas-fired vaporizer is on order for early installation. Liquid propane is received in railroad tank cars and unloaded directly into the storage tank. A 2000-gal. tank and bottle filling equipment were also installed but are not a part of the production plant.

The 30,000-gal. storage tank is of welded construction and is installed horizontally on two concrete foundations. It is provided with two welded steel pipe coils for heating in severely cold weather. Liquid and vapor lines are of extra heavy steel pipe and 300 psi threaded fittings. Pipe joints are made with litharge and glycerine.

Comparable to Steam Boiler

Since the boiling point of liquid propane is in the vicinity of minus 40° F., the storage tank is comparable to a steam boiler, but operates at much lower temperatures. Heat for vaporizing the liquid is furnished by the air circulating around the tank or by the steam coil, if necessary in very cold weather. The pressure in the tank varies with the temperature of the liquid, which may be considerably lower than atmospheric temperature. Available data lists a gauge pressure of 23.5 psi for zero degrees Fahrenheit, 92 lbs. at 60° F. and 240 lbs. at 120° F. for saturated propane. Pressures slightly less than the above are to be expected with commercial propane.

The space above the liquid in the tank is therefore filled with propane vapor under substantial gauge pressure. This pressure furnishes the physical force to inspirate air for the mixture just as our distribution pressure provides means of inspirating air into gas burners.

Distribution

The mixers each have four means of adjustment, nozzle size, vapor pressure at the nozzle, and on and off range adjustments operated by the discharge pressure. Without going into details of the adjustments, I will say that close control of calorific value has been maintained without any particular difficulty. Present operating practice is for one of the servicemen to start two mixers when he gets the truck in the morning. This takes but a few minutes of his time. He checks back about once an hour and if necessary makes minor adjustments. The holder is generally filled in about four hours.

The mixers deliver 900 Btu gas to the surge tank under pressure of 1½ to two lbs. This variation is adjustable and represents the on and off range of the mixers. They are set to turn on when the pressure drops to 1½ lb. and to turn off when it reaches two lbs. Slight variation of the off pressure is the final adjustment for calorific control.

From the surge tank the mixed gas goes through one of the low pressure regulators and the meter, then either to the holders or direct to mains.

We turned the new gas into a small section of our system on Feb. 11, 1946, and into the entire system on Feb. 26. Adjustments were undertaken in the first section with a force of six men and this force was supplemented with eight more for the week of Feb. 26. The force of six men was maintained through March, at which time it was reduced to our normal force of two.

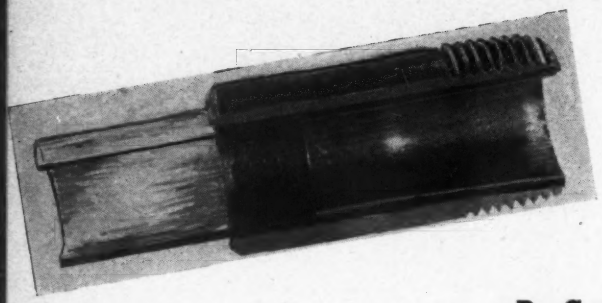
Although the task of adjusting to the new gas was a major operation and caused some inconvenience to customers, there were some very satisfactory results. We found and repaired a considerable number of appliances which had not operated properly for some time. The average condition of appliances is now better than it was. Considerable local interest developed regarding the change-over and a favorable reaction resulted in increased sales of appliances to two groups; namely, a group which had very old stoves and was awaiting the outcome of the change-over before deciding whether or not to change to other fuels, and a group which had not used gas for several years and decided that they would again have a meter installed. Cost of adjusting customers appliances averaged about $2.50 per meter.

Stress Non-Toxicity

The fact that the propane-air mixture is non-toxic was mentioned in one advertisement and has caused more interest than I expected — sufficient to cause some concern as to the extent to which the toxic quality of water gas is being exploited by competition. Possibly we have not done enough in stressing the overall safety of gas in comparison with other fuels.

The use of propane-air mixtures in small properties will, I believe, enable more of these to exist and to contribute to the general development of the industry. It provides a definite and logical tie-in with the bottled gas industry, which has developed rapidly in all parts of the country. Our experience shows that propane is a very satisfactory substitute for manufactured gas.

Results from the conversion at Claremont have been very satisfactory. Substantial savings in production costs plus improved service to our customers have been the major results. We now produce a gas which approaches the ideal of the industry in many ways. It has constant heating value, constant gravity, no organic sulphur, no tar or oil vapors, and negligible water vapor. I believe that better service is possible with this gas and that we will find additional economies beyond the savings in production costs.



PLASTIC TUBING
for Gas Service Piping

By S. A. BRADFIELD and T. H. GILBERT,
Southern California Gas Co., Los Angeles

PART 1. PRELIMINARY INVESTIGATION AND INSTALLATION STANDARDS

FACED with an impending wartime shortage of steel pipe, the Southern Cailfornia Gas Co., like many other members of the gas industry, began in 1942 to search for possible substitutes. The growing acceptance of plastic materials for various purposes in industry led to a series of preliminary investigations of this type of material for use in lieu of steel service pipe.

After consideration of a number of different types of plastic material, it was decided to conduct further preliminary experiments on one type of tubing fabricated locally from cellulose acetate butyrate, known commercially as Tenite II, which, it was learned, might soon be available in usable quantities at a price comparable to that of steel pipe. The selection of this particular material for further consideration was based not only on price and availability, but also on the fact that it is light, easy to handle, and could readily be joined in the field.

The preliminary investigation of this material which was begun in 1942 was divided into four phases: (1) Experiments were made to determine a proper method of application of the material to the construction of gas services, (2) use tests were made by the Operating Departments to determine further proper field practices, (3) laboratory tests determined whether the physical and chemical properties of the material were such as to render it suitable for gas services, and (4) soil tests were made to determine whether the material would stand up when buried in various types of soil.

Application Experiments

The preliminary work, as outlined, which was under the general direction of B. M. Laulhere and was conducted by J. T. Cortelyou and D. C. Hill, included the development of a method of joining the plastic tubing to existing metal piping and a method for making field joints in the plastic tubing itself.

In early test installations, a simple plastic-to-steel connection was shop-fabricated. This connection *(Fig. 1)*, which consisted of a reamed nipple with a tapered steel insert, has since been replaced with a flare compression fitting which is available *(Fig.2.)*

Two types of plastic-to-plastic field joints were originally considered. One of these was made by using plastic sleeves of 1-in. internal diameter which slipped over the two ends of 1-in. O.D. plastic tubing *(Fig. 3)*. Acetone was used as a sealing agent between the sleeve and the inserted tubing. The other type of field joint was made by belling one end of the plastic tubing and inserting the unbelled end of the adjacent piece of tubing into the bell *(Fig. 4)*. Acetone again was used as a sealing agent. The belling of the plastic tubing was accomplished by inserting the end of the tubing in hot water and then pressing it firmly over a mandrel.

The sleeve type connection has proved to be somewhat stronger and generally more acceptable than the bell-and-spigot joint. Standard installation practice now calls for sleeve joints not only because of their greater strength, but also because no hot water and no special tools are required on the job. The sleeves can easily be made in the shop or in the field by simply sawing off short lengths of 1-in. I.D. tubing with a hacksaw *(Fig. 5)*.

Use Tests by Operating Departments

In order to determine the adaptability of the material to field use, a 1¼-in. steel service 38 ft. long was first installed. Instructions were then issued to a field crew to replace this service by the insertion of plastic tubing, using the old service as casing. The instructions also called for an extension of the service with plastic pipe to a total length of approximately 72 in. Both sleeve and bell-and-spigot joints were employed in this installation and the connections to the service tee and to the steel service riser were made by means of fittings similar to that shown in *Fig. 1.* The men who made the installation were asked to comment as to whether they considered plastic pipe acceptable for use as gas services. They were invited also to offer suggestions and comments which might lead to the most successful adaptation of this material to service construction work. The comments indicated their feeling that the use of the material was practical, but all pointed to the fact that because of the softness of the plastic, it might be undesirable to insert the tubing through old steel services where burrs or welding icicles were likely to exist.

After the test service was installed, it was filled with gas to a pressure of

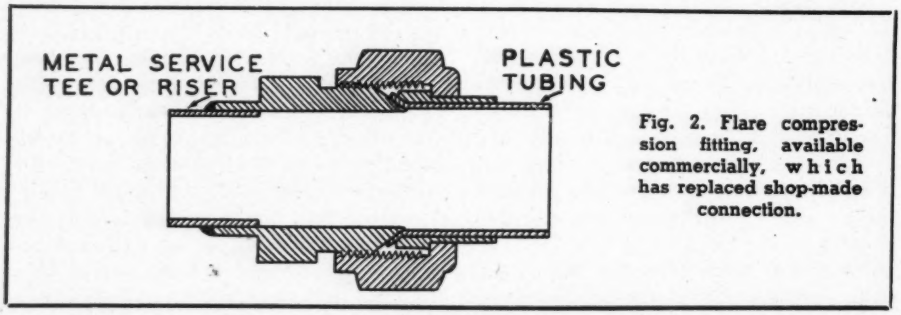


Fig. 2. Flare compression fitting, available commercially, which has replaced shop-made connection.

Results of a program undertaken during the war when the critical shortage of steel for service piping made the discovery of a suitable substitute mandatory. In two parts, the first by Mr. Bradfield, the second by Mr. Gilbert; presented first at the PCGA convention.

Fig. 3. Preparing bell and spigot joint.

30 psi and a recording gauge was installed. The charts indicated no appreciable loss in pressure over a 7-day period.

Preliminary and Laboratory Tests

In order to determine the physical properties which might have a bearing on its use for gas services, samples were delivered to a materials testing laboratory and tests were conducted to determine its tensile strength and its strength against bursting, crushing, bending, and general abuse. Results of these preliminary tests indicated an ultimate strength in tension of approximately 5000 psi at 84° F. The test specimens generally withstood hydrostatic tests in excess of 600 psi at 80° F. and approximately 380 psi at 130° F. When crushed between two ¾-in. diameter bars, 12-in. specimens required approximately 270 lbs. to close at 84° F. At a temperature of 85° F. the specimens generally withstood bending around a 23-in. diameter mandrel but buckled on a 20-in. mandrel. At 20° F. specimens shattered when hit flat on top and kinked when hit on a sharp edge. At 160° F. specimens would not shatter, would kink if hit on a sharp edge, and could be hammered flat without breaking. Since the range of ground temperatures in the Southern California area is generally between 50° and 70° F., and since there is little likelihood of services being subject to sharp impact, it was felt that the results of these tests indicated that the plastic was physically adaptable for service installations.

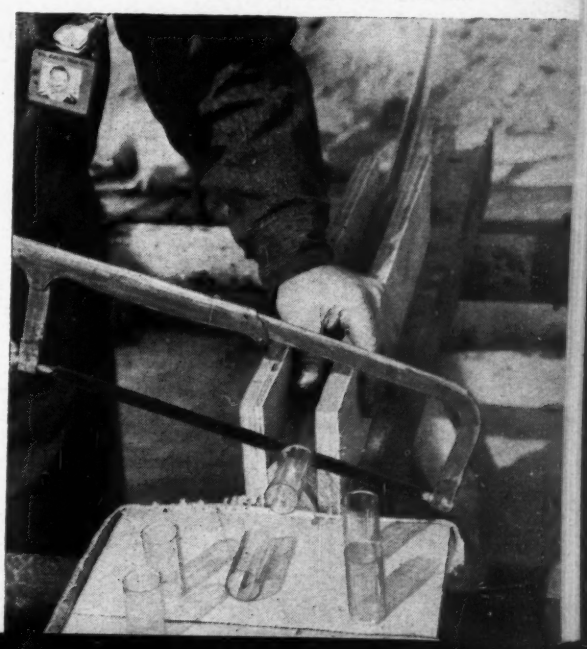
Chemical tests were also conducted at this time to determine the effects of various solutions upon the plastic material. Twelve-inch samples of plastic pipe were immersed in eight different chemical substances for a period of 19 days. The samples were then removed, dried, and any change in weight was noted. After the samples had stood for 30 hours, their change in weight was again noted and they were subjected to tensile tests. The eight substances in which the samples were immersed were:

a) Lubricating oil
b) Absorption oil
c) 1% solution of hydrochloric acid
d) 1% solution of sulfuric acid
e) 20% solution of calcium chloride
f) 10% solution of sodium chloride
g) Natural gas saturated with natural gasoline
h) Natural gas saturated with Calodorant

Each of the last two tests was made by wiring the samples in the middle of a sample bomb made of 2-in. pipe, placing a small pool of natural gasoline or Calodorant in the bomb, and filling the bomb with natural gas. The pool of liquid did not touch the plastic tubing but the gas surrounding the sample was saturated with the vapors of the liquid. Natural gas saturated with Calodorant and natural gasoline both seemed to cause an appreciable change in weight in the test sample, Calodorant having the greater effect. Since, however, the concentration of Calodorant in the bomb was approximately 1000 times that in gas normally supplied through services, it was felt that the apparent effect on plastic could be disregarded. This consideration has been borne out in later tests performed on services through which gas has passed for a period of approximately three years without any apparent effect on the physical properties of the tubing. In the light of these tests, however, our policy restricts installation of plastic services to areas where there is little likelihood of contact with refinery gases or high concentrations of mercaptans.

Fig. 4. Preparing sleeve joint.

Fig. 5. Cutting plastic sleeves.



Soil Tests

In order to determine how plastic pipe would stand up in service underground, approximately 2200 ft. of the material, both plain and jointed, was buried in soil beds of the three prin-

TABLE 1. COMPARISON WITH OTHER MATERIAL

1. Plastic services are more easily field fabricated than are steel services. It has been found that, with very little training, men can easily make the sleeve type joints. Service tee and riser assemblies, as delivered to the field crews, now include attached compression fittings with 9-in. flared plastic nipples, to which the remainder of the service can be connected with sleeve joints, eliminating the necessity of fabricating any plastic-to-metal connection in the field.

2. If a mechanical service tee is used instead of a welding tee, there is no necessity for a welder to be included in the lineup of a crew laying plastic services.

3. Plastic material is very light in weight. The entire length required for an average service can easily be handled by one man.

4. The necessity for protecting joints other than that at the service tee is eliminated. By using a grease coating with cellulose and Kraft paper to protect the service tee connection, the necessity for the use of hot asphalt with its attendant hazards and time-consuming heating process is eliminated.

Disadvantages

1. The principal difficulty which has so far been encountered in the use of plastic has been in obtaining a proper fit between sleeves and inserted tubing. Both the 1-in. O.D. and the 1-in. I.D. tubing have been found to vary in diameter as much as plus/minus 10/1000-in. This variation in size often results either in joints so loose that voids are not completely filled by the sealing agent, or so tight that the sealing compound is scraped off in making the connection. In some cases the variation has been so great that it was impossible to insert the tubing in the sleeve.

In order to overcome the difficulty, it is at present necessary to use a special pipe sizing tool in the field. By forcing the end of the tubing between the inner and outer shells, which have been previously heated by dipping in hot water, a proper diameter is obtained. It is hoped that fabricators of plastic tubing will, in the near future, be able to hold the diameter of extruded tubing within a much closer tolerance—say plus/minus 3/1000-in.

2. The plastic material is soft and easily cut and does not withstand rough treatment from picks and shovels. Since, however, services are normally laid approximately 18 in. deep across the customers' premises, and since this is below the depth of normal cultivation on the property, we do not anticipate that a great number of services will be broken or cut by garden tools. To our knowledge, only two plastic services so far have been damaged in this way. Both of these were broken by workmen constructing other pipe lines crossing the services.

3. The possibility of fatigue or flowing of the plastic material at the compression fittings has been considered. As yet there has been no evidence of any leakage or deterioration of a service from such a condition.

cipal types of soil fund in this area: sand, loam and adobe.

In each of these general types of soil, samples were buried in two different beds, one of which was maintained in a naturally dry condition and the other of which was kept perpetually wet by means of a sprinkling system. Samples were also buried in a sand bed in which the sand had been thoroughly oiled and in which the pieces of plastic pipe were wired to a storage battery which maintained a potential of six volts on the test samples with respect to the soil. Sufficient samples were buried so that one could be dug up from each bed and tested every six months for a period of approximately three years.

This test has been completed and the results indicate that only in the oil saturated sand has there been any appreciable deterioration of the material.

In the light of the preliminary investigations which were begun in 1942 and were completed this year, it was decided that the plastic tubing under consideration was adaptable for service installation work. A number of plastic services were installed during the latter part of 1945, and this year with the steel situation still critical, several crews have been assigned to the installation of plastic services in selected areas. Before beginning any formal program for the installation of plastic services, it was considered necessary to adopt procedure standards and to obtain on the open market fittings which would replace the home-made connections formerly used. With this end in view, a rather detailed investigation was made in our laboratory. T. H. Gilbert has covered this investigation in Part 2 of this treatise, entitled "Laboratory Testing and Development."

Following the conclusion of the final laboratory investigation, a number of general rules were adopted relative to the installation of plastic tubing for gas services. These general rules include the following 15 items:

General Rules

1. *Type of Service.* "Plastic tubing will be used for domestic standard services only. Branch services will not be connected to a plastic service."

The decision to use plastic for domestic standard services only was based on a desire to limit to a single size the tubing and fittings in use at the present time. Because of the difficulty of obtaining fabricated plastic fittings such as T's, and the undesirability of increasing the number of steel-to-plastic connections in a given service, it was considered impractical to attempt currently the installation of branches from plastic services.

2. *Pressure.* "Plastic services may be used on pressures not to exceed 30 psi."

Although plastic joints and tubing have been subjected to much higher pressures and have successfully withstood the tests, it was felt desirable to limit the pressure to insure an adequate factor of safety.

3. *Soil.* "Plastic services will be installed in mild soil areas only. Installation of plastic services should be avoided in extremely rocky areas."

The decision to use plastic in mild soil areas only resulted primarily from the difficulty encountered in applying a protective shield to the coating at the plastic-to-steel joint. Since plastic softens materially with heat, hot asphalt cannot be used to protect the steel connection. A grease coating is therefore used which is protected only by two wraps of cellulose acetate and a shield wrapping of Kraft paper.

It was considered desirable to avoid

the installation of plastic tubing in rocky areas because of the fact that in compacting the backfill, rocks might lie against the tubing and eventually cause a partial closure.

4. Coating. "Main and service tees will be coated with a grease coating, two wraps of cellulose, and Kraft paper to protect cellulose and grease during backfilling operations. Hot asphalt will not be used.

5. Identification. "A brass ring will be installed at the stop cock on all plastic services."

In order to provide identification for future operation and maintenance, it was felt desirable to mark in the field each plastic service which was installed. Since it has been common practice to use a yellow harness ring to mark services to which branches are connected, a different kind of a ring is used to differentiate between plastic and branch services.

6. Riser. "The riser will be of copper, connected to the plastic pipe by means of a compression type mechanical fitting."

By the use of a copper riser with a brass compression fitting attached, the necessity for coating the metal-to-plastic connection is avoided.

7. Protection to Service Riser. "The plastic-copper joint at the riser connection should be blocked securely on the sides to avoid kinking of the plastic material until the backfill is well compacted. Wood scraps, or similar material will provide the necessary rigidity."

8. Service Connection. "Service connection to main may be either the welded or mechanical type connected to the plastic pipe by means of a compression fitting."

9. Pipe Joints. "Pipe joints will be made with a 1-in. I.D. plastic sleeve over the 1-in. O.D. plastic pipe, sealed with plastic pipe joint cement."

The plastic pipe joint cement currently in use is a solution of the plastic material in acetone with a coloring material added to provide for visual inspection of the joint. It has been found that a better joint can be obtained by using this material than by simply painting the ends of the tubing with acetone.

10. Service Location. "Particular care must be taken to secure and record clear and accurate service locations because of the fact that pipe locators will not locate the pipe."

TABLE 2. JOB BREAKDOWN SHEET

Operation: Fabricate Plastic Pipe Sleeve Joint (Relates to Standard Practice 1550.1)

Equipment Used: Blue Paste #1, ½-inch Brush, Clean Rag, and Acetone for Cleaning Brush and Thinning Blue Paste.

Important Steps	*Key Points*
1. Remove all grease and dirt from inside of sleeve and outside of plastic pipe or nipple with clean rag.	1. Joint must be thoroughly cleaned.
2. Apply paste to one-half of the inside surface of plastic sleeve.	2. (a) Use paste generously. (b) Apply as quickly as possible. (c) *Do not* leave voids when applying paste, cover completely. (d) Keep all matches or flames away from Blue Paste #1 or Acetone as both are highly inflammable.
3. Apply paste to outside of plastic pipe or flared nipple at the end to be joined.	3. A distance of two inches.
4. Insert end of plastic pipe or nipple *straight* into plastic sleeve, approximately one-half the length of the plastic sleeve.	4. (a) *Do not twist.* (b) Joint must be made *immediately* after paste has been applied due to its setting up rapidly.
5. Apply paste to second half of the inside surface of plastic sleeve.	5. Same as Step 2.
6. Apply paste to outside surface of second pipe end to be joined.	6. Same as Step 3.
7. Insert end of plastic pipe or nipple *straight* into plastic sleeve until it butts up to first plastic pipe end.	7. Completed joint should not be disturbed for about five minutes.
8. Wipe off excess paste with rag.	
9. Clean brush.	9. Use Acetone.
10. Test joints.	10. (a) Test in same manner as steel pipe joints. (b) Use 25 lb. or main pressure, which ever is greater. (c) Use ¾ in. safety expansion plug to stop end of pipe.
11. If joint leaks, cut out entire joint.	

Show well defined location of service on service order—plastic service cannot be located with pipe locator.

11. Boring and Jetting. "Plastic pipe will not be used for boring or jetting."

The reason for this restriction is the obvious lack of rigidity of the plastic material.

12. Curb Valves. "Curb valves may be installed in plastic services using compression type fittings for connection."

The same method is used to connect curb valves to tubing as is used with copper services, i. e., extra heavy T.O.E. nipples extend from the inlet and outlet of the curb valve through the edge of the valve box or casing. In case of plastic installations, these nipples are terminated by compression type fittings at the outer ends through which plastic-to-metal connections are made.

13. Service Bends. "Plastic pipe may be curved gradually as it approaches the riser location in lieu of a service bend. When right angle bends are required, the prefabricated plastic service bends will be connected to the pipe with sleeve joints."

TABLE 3. JOB BREAKDOWN SHEET

Operation: Connect Plastic Service to Steel Service Tee or Service Riser. (Relates to Standard Practice 1550.1)

Equipment Used: Crescent Wrench, Hacksaw, Rule, Blue Paste #1, ½-in. Brush, and Clean Rag.

Important Steps	*Key Points*
1. Remove union nut and metal compression ring from service tee or riser assembly.	
2. Cut plastic service to length.	2. (a) Use hacksaw with fine tooth blade. (b) Cut straight.
3. Install metal compression ring on plastic nipple. (Flared one end.)	3. Flared end of compression ring to contact flare on plastic nipple.
4. Install union nut on plastic nipple.	4. Threads in union nut toward flared end of plastic nipple.
5. Join plastic nipple to plastic service. (See breakdown "Fabricate Plastic Pipe Sleeve Joint").	5. Completed joint should not be disturbed or connected to fitting for about five minutes.
6. Connect union nut to fitting on service tee or service riser.	6. (a) Do not apply dope to union nut or fitting threads. (b) Use Crescent wrench. (c) Tighten union nut snugly, yet not excessively. (Plastic flare will break if nut is tightened to excess.)
7. Install a "Plastic Service Identification Ring" at the stopcock on the service riser.	

14. Abandoning. "Plastic services will be abandoned at the main except where a curb valve has been installed, in which case the service may be cut at the valve and the valve plugged."

15. Standard Practices. "In general, specifications as outlined in 'Standard Practices for the Construction of Steel or Copper Services' will be applied where plastic pipe is used."

The details listed above include the more notable exceptions.

Training Program

As installation techniques were developed in the laboratory, booklets were prepared in which were included the general instructions outlined above, as well as job breakdown sheets showing in detail the important steps and points to be watched in making plastic sleeve type joints to connect plastic tubing to service tees or copper service risers *(Tables 2 and 3.)*

After the development of techniques had been completed and the booklets prepared, district foremen and other interested supervisors met at the laboratory for a demonstration of the operations. Following this demonstration, the foremen themselves went through the procedures outlined in making and testing sleeve connections and installing compression fittings. Booklets were then distributed to the district foremen for their use in training individual crews in the installation of plastic services.

In order to determine how effective the training had been, representatives of the Distribution Training Department and operating supervisors later spot-checked a number of service installations to see if standards were being followed and if any changes in instructions were necessary. To date few modifications of the original outlined procedures have been found desirable.

Although no wholesale program for the installation of plastic services in lieu of steel or copper has as yet been necessary, several hundred installations have been made. The experience gained from making these installations indicates certain advantages in the use of plastic over the use of steel. The more apparent advantages as well as disadvantages are listed in *Table 1.*

The ultimate life of plastic service pipe is still a matter of conjecture. From three years of observation, however, it is considered likely that under proper conditions, plastic will last at least as long as steel. Its installed cost compares favorably with that of steel. In the light of nearly four years experience, we feel that after minor difficulties have been overcome, plastic will be a highly satisfactory substitute for metallic service pipe.

PART 2. LABORATORY TESTS, DEVELOPMENT

WITH the recent acceptance of plastic materials for various purposes in industry and the presnt shortage of pipe metals in mind, the Southern California Gas Co. has made a number of laboratory tests to determine if this material could be used for gas service piping to good advantage. The plastic tubing tested is commercially known as Tenite II. Its properties are listed in technical handbooks. This paper is a progress report of the tests and experiments performed to date to determine the acceptability of this product.

The tests and experiments consist of three phases as stated below:

a) Physical and chemical testing of plastic tubing.
b) Plastic-to-metal joints.
c) Plastic-to-plastic joints.

Physical and Chemical Tests

In order to determine the properties of plastic tubing which have a bearing on its use for gas piping, samples were tested to determine their capacity for withstanding internal hydrostatic pressure, crushing, and impact, and also to determine the burning rate and ignition temperature of the tubing. It was realized at the beginning of the test work that the results of all tests of physical properties would be extremely sensitive to temperature and rate of application of load. Therefore, an attempt was made either to control these variables or obtain sufficient data under various conditions to evaluate properly the results.

Test of Bursting Strength

Test specimens, 10 in. long, were cut from a length of tubing and assembled in couplings as illustrated in *Fig. 1.* This assembly was placed in a water bath and maintained at a desired temperature for 10 min. The specimen was then connected to a hydraulic pump, and pressure was applied at the rate of 15 psi/sec. until failure. The re-

sults of this test are shown in *Fig. 2*. The data for the solid line curve was obtained from unused tubing, while data for the dotted line curve was obtained from tubing which had been installed as a service, and had been in use approximately one-half year.

Test of Crushing Strength

A 6-in. length of plastic tubing was placed horizontally on a flat steel plate, and a 2⅛-in. diameter steel ball was placed centrally on the tubing. A crushing force was then applied vertically downward on the steel ball by a hydraulic ram at the rate of 6 lbs./min. A similar test was made with ¾-in. soft drawn copper tubing. A force of approximately 160 lbs. was found necessary to completely collapse the plastic tubing within the temperature range from 65° to 80° F., while it required a force of 1460 lbs. to collapse the copper tubing. Thus, it appears that plastic tubing has roughly one-tenth the resistance to crushing of soft drawn copper tubing.

Test of Resistance to Impact

The purpose of these tests was to determine the effect of impact loads on the bursting strength of plastic tubing over a range of temperatures, using several different types of impact heads. Six-inch specimens and the test apparatus were arranged as shown in *Fig. 3*. After each impact, the test specimen was subjected to a hydrostatic pressure test. A summary of these results is shown in *Fig. 4*. It is evident from these results that care should be taken not to drop any objects on the tubing, especially pointed or edged objects, such as picks or shovels. However, it was found that there was no appreciable damage to the tubing unless the tubing wall was actually pierced or cracked.

Flame Tests

Tenite II is easily ignited by a match, and when ignited it burns with a self-sustaining blue, yellow tipped, flame. The temperature of this flame is about the same as that of a match flame, or approximately 1600° F.

The Cleveland Open-Cup Flash-and-Fire-Point test was used to try to determine the ignition temperature of the material. Small pieces were cut and shaved from plastic tubing and melted in the cup. The normal ASTM test procedure was followed after the plastic had melted. The flash point was found to be from 500° to 530° F., and the fire point from 550° to 570° F.

From an article by H. C. Porter, entitled "Ignition and Ignitibility," appearing in "Industrial and Engineering Chemistry," Aug., 1940, it would be deduced that the ignition temperature of cellulose acetate floc would be approximately 560° to 570° F. Since Tenite is a molded, thermoplastic, cellulose acetate, and Tenite II is a ther-

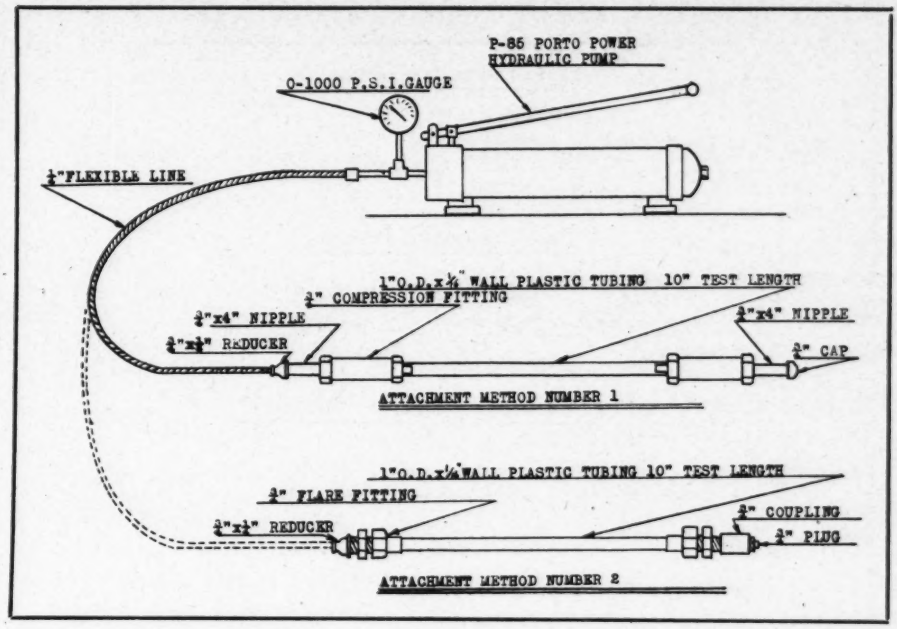


Fig. 1. Hydraulic pressure assembly for bursting strength tests.

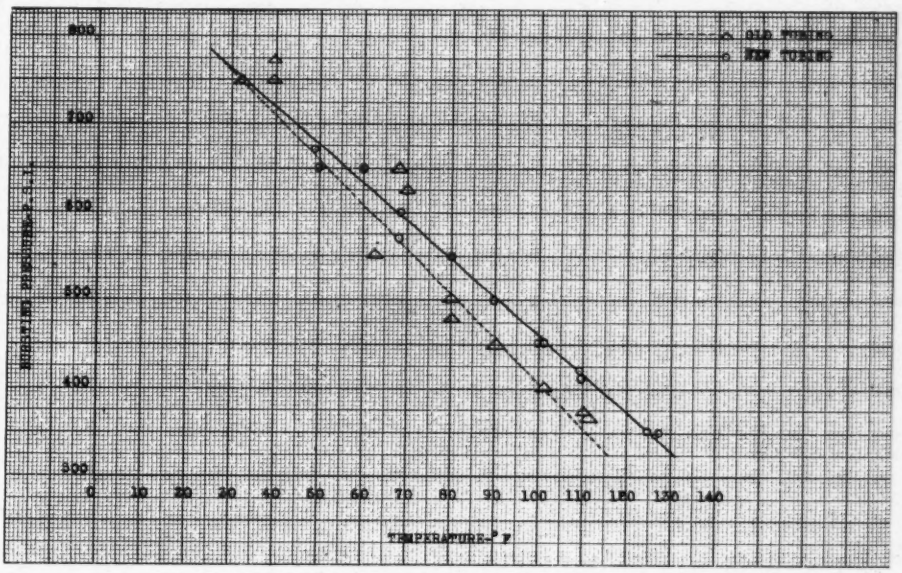


Fig. 2. Graphs showing effect of temperature on bursting strength of old and new plastic tubing.

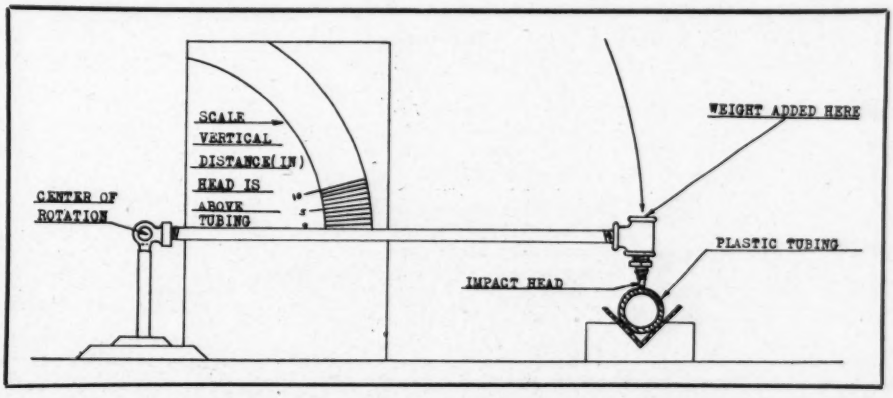


Fig. 3. Apparatus for impact test of plastic tubing.

TABLE 1. RESULTS OF CHEMICAL TESTS

Pipe Protective Grease*

Sample No.	% Loss in Wt. upon removal	% Loss in Wt. upon standing 24 hours	Net % Loss in Wt.	Appearance
1	0.39	0.	0.39	No change
2	0.39	0.06	0.45	No change

Pipe Protective Primer*

	% Gain in Wt. upon removal	% Loss in Wt. upon standing 24 hours	Net % Gain in Wt.	
1	1.96	0.88	1.08	No change except for very slight amber tint.
2	2.11	0.94	1.17	

Pipe Protective Primer Thinner**

	% Gain in Wt. upon removal	% Loss in Wt. upon standing 24 hours	Net % Gain in Wt.	
1.	3.32	2.45	0.87	No change.
2	3.24	2.50	0.74	No change.

Gasoline (Leaded)

	% Loss in Wt. upon removal	% Loss in Wt. upon standing 24 hours	Net % Loss in Wt.	
1	3.31	3.49	0.18	Amber discoloration.
2	3.56	3.73	0.17	No other change.

Alkaline Water Solution of Tri-Sodium Phosphate

Sample No.	Solution Strength	% Gain in Wt.	Appearance	Bursting Pressure Psi	Test Temp. °F.
1	1%	1.65	Very light film, easily rubbed off. No apparent damage.	475	80°
2	1%	1.62	"	475	80°
3	5%	1.43	Light film, easily rubbed off. No apparent damage.	475	78°
4	5%	1.49	"	475	78°

Alkaline Water Solution of Sodium Carbonate

5	5%	1.51	No change in appearance; No damage apparent.	475	78°
6	5%	1.54	"	475	79°
7	1%	1.66	"	475	79°
8	1%	1.67	"	475	78°

*Composed of petroleum constituents.
**A straight run and non-aromatic petroleum derivative similar to solvent naphtha.

Saturated Benzol Vapor

Sample No.	% Gain in Wt.	Appearance	Bursting Pressure Psi	Test Temp. °F.
1	23.2	Both samples expanded to an O.D. of 1-1/32 in. and were somewhat pliable. The surface of the tubing was still smooth, hard and had its original color and shape.	275	77°
2	24.9		300	77°

Manufactured Gas

Sample	Exposure Time Days	Volume of Gas Passed through Tubing in cu. ft.	Bursting Pressure Psi	Test Temp. °F.	Remarks
1	0	0	555	78	
2	14	18,500	475	82	Exposure had increased O.D. a slight amount.
3	14	18,500	500	78	
4	55	72,500	450 480	78	Start of bulge. Tube split.
5	55	72,500	450 480	78	Start of bulge. Tube split.

moplastic cellulose aceto-butyrate having closely allied properties, it is logical to assume that both have similar ignition temperatures.

The ASTM D568-40T method of test was selected for the determination of the flammability, or burning rate, of plastics in sheet form. The "Proposed Test for Other Than Films" was used in this case. Test specimens 6 in. long by ½ in. wide by 1/16 in. thick were used for all tests. A 4 in. test length was marked off in the center of the strip. Similar pieces of pine and oak wood were tested in the same manner. The rate of burning, in inches per minute, was determined as follows:

Tenite II	**1.60**
Pine	**2.26**
Oak	**1.92**

It appears, then, that this plastic tubing burns more slowly than some common woods used in house construction.

Chemical Tests

These tests consisted of immersing in or subjecting samples of plastic tubing to several different chemical substances for a known period, weighing before and after removal, noting physical appearance, calculating per cent gain or loss in weight, and subjecting some of the samples to a hydrostatic pressure test. The results of these tests are shown in *Table 1.* All samples were immersed for a period of 14 days at room temperature, except as noted in the table.

Plastic-to-Metal Joints

In order that plastic pipe be of any use as gas service piping, it is necessary that it be joined to existing metal piping. Several types of commercially available fittings which were believed suitable for this purpose were investigated and tested. Three types of compression fittings are shown in *Figs. 5, 6 and 7.* The flare fitting is shown in *Fig. 8.* A flaring tool, which was designed by A. B. Meyer for flaring the ends of plastic tubing to use with the flare fitting, is shown in *Fig. 9.* The plastic tubing is flared by heating both the flaring tool and the tubing end in boiling water, and forcing the tubing over the tool.

Joints made with these various fittings were subjected to hydrostatic pressure tests and tensile pulls until either the tubing failed or the joint failed because of leakage or slippage. It was found that any of these fittings could be used to join plastic tubing; however, the compression fittings do not grip the tubing so well as the flare fitting.

Tests were then made to determine

the optimum torque which could be used in setting the compression nut of the flare fitting without damaging the wall of the flared tubing. As a result of these tests, a torque of 20 ft./lbs. was recommended as the optimum.

Plastic-to-Plastic Joints

The use of plastic tubing for gas service piping involves, at least, two plastic-to-plastic joints. It was proposed to make a sleeve-type joint, as illustrated in *Fig. 10*, using acetone as a cement. Preliminary testing indicated that straight acetone considerably weakened the tubing wall at the ends of the sleeve. This led to an investigation of various adhesives or cementing agents. The adhesives tested were:

1. **Ethyl Alcohol, C. P. absolute.**
2. **Acetone, C. P.**
3. **Blue Paste No. 1. This is prepared by dissolving one part by volume, of chopped Tenite II in four parts of acetone. These parts are not critical. A colorless viscous liquid should be obtained. To render it visible on the tubing, amounts of Kiton Blue or Methylene Blue were added in quantities sufficient to impart to it a deep blue color.**
4. **Commercial Adhesive "A", a quick-setting non-viscous liquid.**
5. **Commercial Adhesive "B", a slower-setting, viscous liquid.**

Simultaneously with the above, the problem of the method of application of the adhesives was investigated.

Joints made with the adhesives were pressure tested, as outlined previously, after the joints had been allowed to set for various periods of time. The results of these tests indicated that satisfactory joints were obtained with all adhesives under ideal conditions of close tubing tolerances, etc., but that Commercial Adhesive "B" was the best of the adhesives tested for field use. It was also found that the method of application of the adhesive is not critical so long as the mating surfaces are covered with adhesive. The method most likely to insure this is that of painting the interior of the sleeve and the exterior of the nipples. Dipping the sleeve insures surface covrage, but is no improvement over painting, and it is attended with the disadvantage of covering the operator's hands with adhesive.

Long-Time Test

As an additional long time test, for determination of any indication of probable deterioration from soil and gas influences over a period of years, a number of identical specimens have been prepared as follows:

Two lengths of tubing suitable for bursting pressure tests, one filled with natural gas and stoppered at each end,

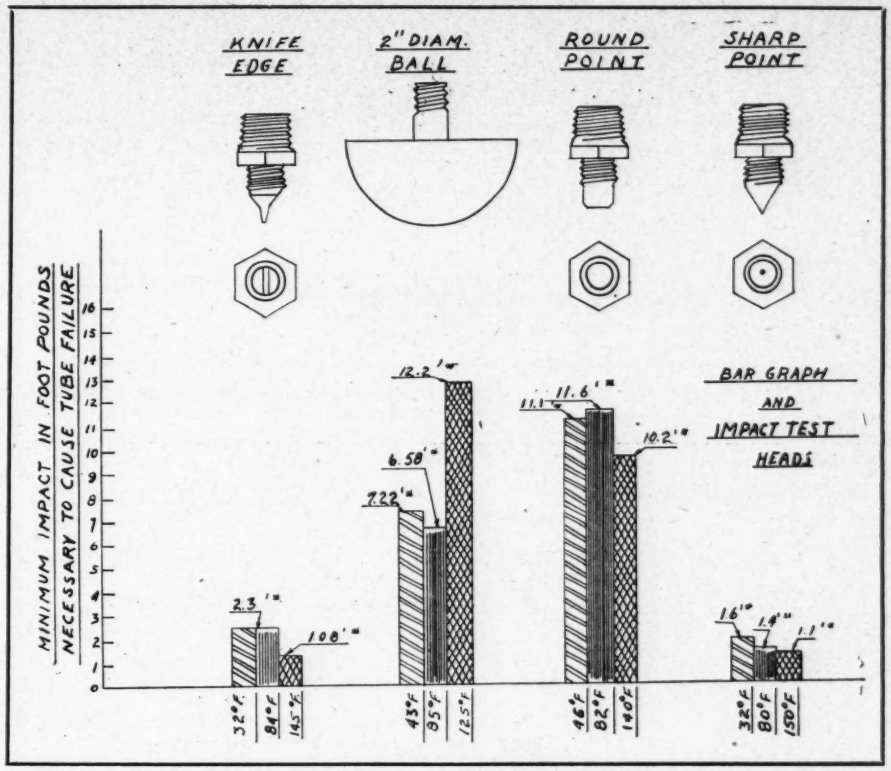


Fig. 4. Types of impact heads and corresponding impact (in ft.-lbs.) to cause failure at lower-than-normal bursting pressure.

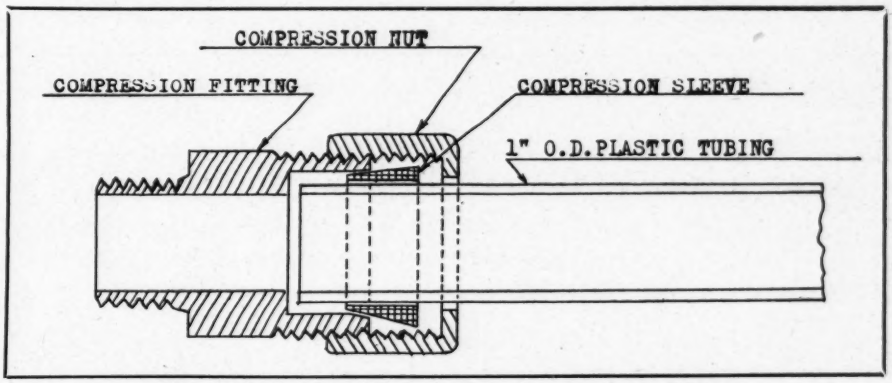


Fig. 5. Compression fitting using metal compression sleeve.

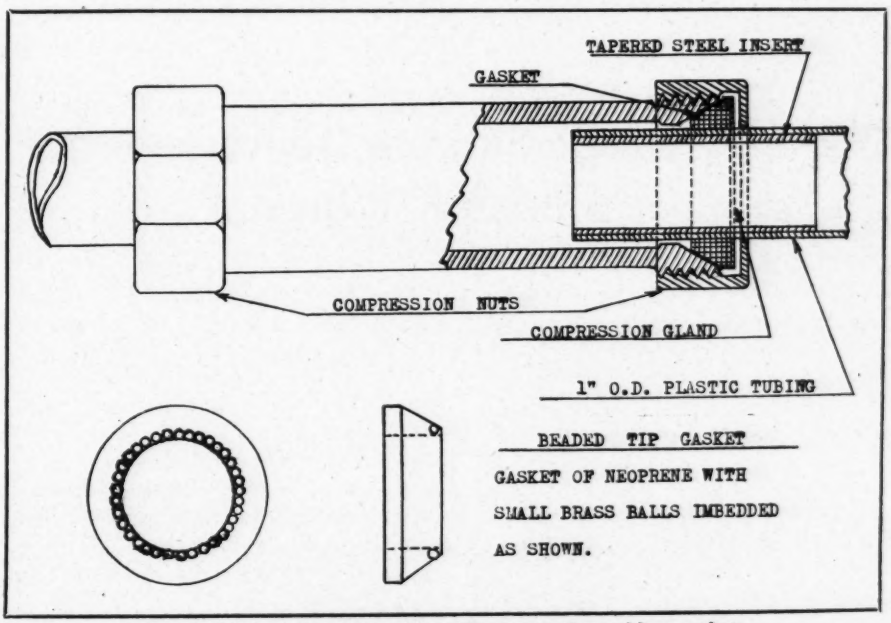


Fig. 6. Compression fitting using V-cross-section rubber gasket.

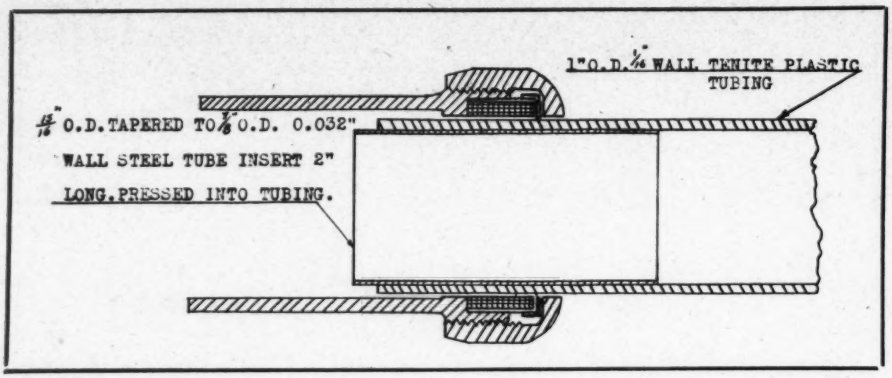


Fig. 7. Compression fitting using rectangular cross-section rubber gasket and internally inserted metal stiffening tube.

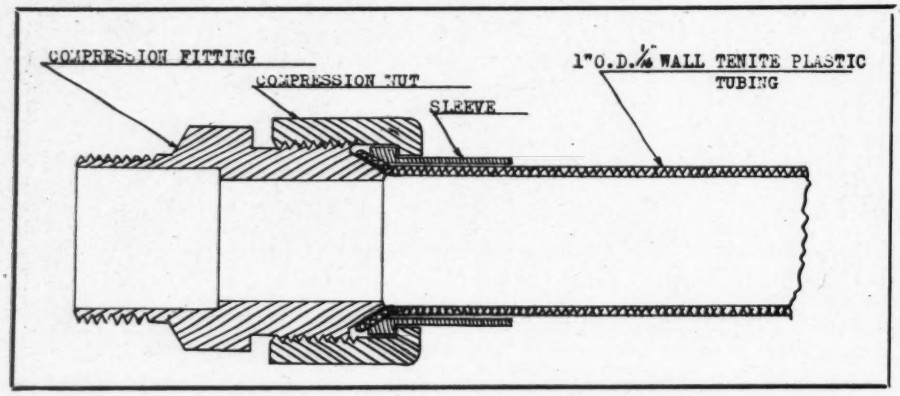
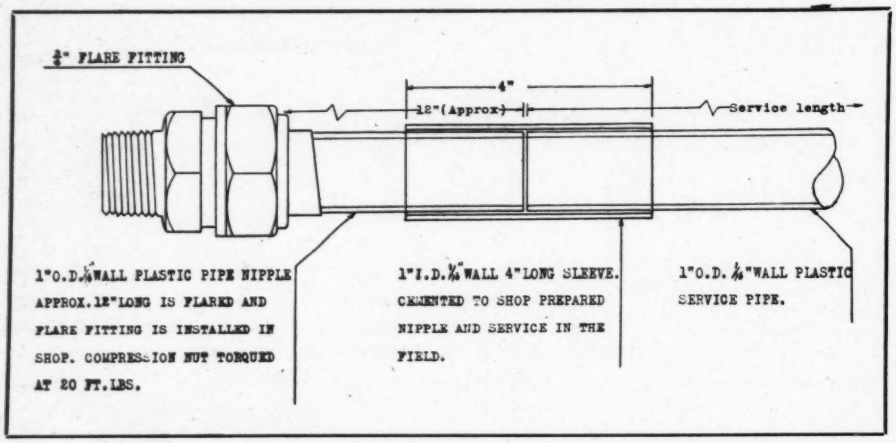


Fig. 8. Flare fitting using metal compression sleeve engaged with compression nut.


¾" FLARE FITTING
4"
12"(Approx)
Service length
1"O.D.¼" WALL PLASTIC PIPE NIPPLE APPROX. 12" LONG IS FLARED AND FLARE FITTING IS INSTALLED IN SHOP. COMPRESSION NUT TORQUED AT 20 FT. LBS.
1"I.D.¼" WALL 4" LONG SLEEVE. CEMENTED TO SHOP PREPARED NIPPLE AND SERVICE IN THE FIELD.
1"O.D. ½" WALL PLASTIC SERVICE PIPE.

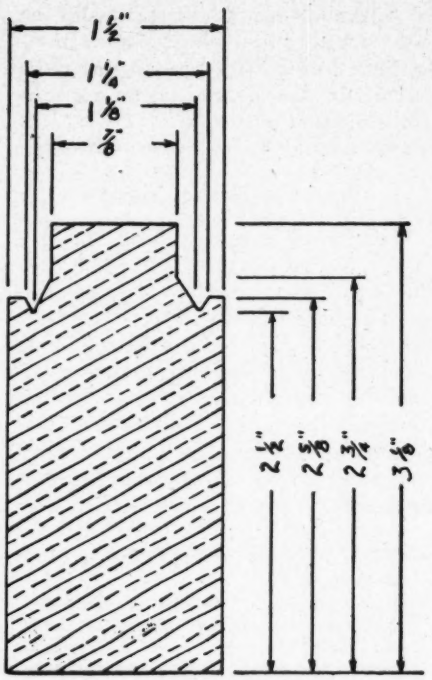


Fig. 9. Cross section of plastic tubing flaring tool for 3/4-in. flare fitting. Made from copper or brass 1½-in.-diameter stock.

Fig. 10. Typical field joint for plastic tubing using plastic pipe sleeve into which plastic tubing ends are inserted and cemented. (At left.)

the other stoppered at each end but not containing natural gas, were placed in the center of a sealed glass jar filled with moist alkaline soil of known pH. These assemblies are stored in our laboratory at normal room temperature, and two will be tested at the end of each six-month period.

On the basis of all information presently available, plastic tubing can be satisfactorily connected, joined to metal piping, and is strong enough to make it suitable for gas service piping underground.

Two-Day Home Service Development Conference in Boston Planned

UNDER the direction of Lillian P. Dunbar, A. G. A. home service chairman and NEGA home service educational committee chairman, program planning for a two-day Home Service Development Conference to be held in Boston Oct. 24-25, has been under way for some weeks. About 65 persons are expected to attend the conference, sponsored by the home service group, sales division, New England Gas Association.

President Knowlton and Executive Secretary Belden of the NEGA, Home Service Counsellor Jessie McQueen of the A.G.A., Chairman Hiller of the NEGA Sales Division, Mrs. Dunbar and her assistant, Susan Mack, will open the first session of the conference. This session will be devoted to "New Viewpoints" including remarks by home service representatives who have joined the gas industry during the past year, a talk entitled "What Do We Lack That We Should Have?" and a quiz contest to develop new ideas.

The second session will present youth classes, brides', employees' and men's classes, and talks on planning modern kitchens for homemaking instruction, and home service participation in the community. A third panel will feature discussions on home laundry mechanics, frozen foods, pressure saucepans and addresses on "New Revenue Loads" and "Gas in the Modern Kitchen."

A gas industry executive will speak on "What Management Expects of Home Service" at the final session, and there will be sales promotion presentations covering recent developments in this field.

Norman Millard, superintendent, Domestic Sales Division, Boston Consolidated Gas Co., is chairman of the committee handling exhibits.

Spotlight ON THE GRIDDLE TOP

More Western women use WEDGEWOOD than any other gas range, and one reason is WEDGEWOOD'S popular griddle top, which adds 50% to actual cooking top facilities. The griddle is of chrome plated cast metal, ideal for hot cakes, eggs, bacon and many other delicious foods. It drains grease into special removable drawer, and is quickly removable for easy cleaning. Burner is self lighting.

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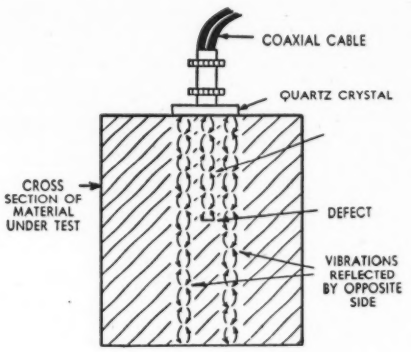
SUPERSONIC REFLECTOSCOPE

And Non-Destructive Testing of Welded Pressure Vessels



By O. R. CARPENTER

Babcock & Wilcox Co., Barberton, Ohio

WHEN radiography was first adopted for the examination of welds, it was a sufficient miracle for a piece of steel to be penetrated and examined by this radiation without too many additional thoughts concerning the technique used. The practice adopted was that which was then used for medical work. Only one grade or type film which used calcium-tungstate intensifying screens was available. There resulted a coarse-grained radiograph with reasonably good contrast but with very poor detail.

The early tubes were medical types with large focal spots. The first machine installed in the author's plant in 1929 used an early 200-kv. therapy tube. It was advertised by us as good for the examination of 3-in. welds. Such thicknesses were, in fact, examined. Questions sometimes arose at that time as to why certain types of defects were not readily found. The sectioning of test plates, which appeared very satisfactory on a radiograph made in these early times, often revealed a fine line of lack of fusion throughout the full length which would not be missed by today's practices.

Bucky Grid Developed

Very little change in industrial technique took place for five to six years. Higher voltage tubes were developed and in about 1937 we first began to use 400 kv. Secondary and scattered radiation began to get more consideration and for its control the industrial Bucky grid was developed.

Real advances in radiographic technique began, in my opinion, when the no-screen type film first became available. This must have been sometime in 1939. Shortly afterward, in 1941, the million-volt machine was developed and placed in service. The use of this machine clearly indicated the need for more than one-grade film for different voltages, techniques and circumstances, and shortly afterward the film companies fulfilled this need. Such fulfillment meant much in the improvement of radiographic techniques. The former conception that 2% sensitivity is a good radiograph no longer holds. Good work today usually will mean a sensitivity of less than one-half of 1%.

Since the development of the million-volt machine, a two million-volt has been available.

New Problems

During the period of radiographic advances just discussed, welding methods and our understanding of the art of welding have also advanced. But as in any process, as we learn more about what happens in a weld, we also find new problems which had heretofore not been recognized. The particular problems of six or seven years ago were those of weldability of material, the mechanics of making a good weld, and the tools then available to work with. Few will deny that welds completely free of slag, porosity and cracks were relatively rare at this time. Today, while problems of weldability are still with us, gross defects in production welding are relatively uncommon and a good many feet of welding is often done which is radiographically perfect.

However, in reaching these improved results, we have also learned to recognize another type defect which we did not notice in earlier uses of fusion welding. The reasons for its more recent recognition are probably the improved radiographic techniques, the use of higher energy input welding methods, and a more efficient application and a better understanding of the welding processes.

We have learned to call these defects plate segregations or inclusions. They may occur in any type of weld made in any of the grades of carbon steel plates. They are seldom found in the alloy steels.

Origin of Cracks

It is generally accepted that these cracks and voids originate from sulphide inclusions which may be arranged in segregated bands or streaks in the plate material.

The formation of these cracks and voids is almost certainly due to the oxidization of the sulphides into an SO_2 as which then forms in pockets; and these, under high pressures, actually cause failure and the opening up of zones of weakness in the plate at the inclusion areas, or in the weld metal along columnar grain boundaries. In multipass open arc welding these results often are not as serious as in submerged arc welding because the fluxes used by this method are usually reactive enough to take care of the SO_2 gas as quickly as the oxidation of the sulphides produces it.

Surface Holes

As the weld deposit passes the point of origin of the sulphide there may remain, however, enough heat and oxygen present to produce further SO_2 from any remaining sulphides, causing a void at the fusion line. In fact, sometimes a series of surface holes will form in the deposited bead of metal which are not evident until the slag has been removed. That is, there has not been any evidence of the occurrence of holes by observation o fthe weld crater during welding.

It is known that certain amounts of sulphur in steel have no deleterious effect upon the weld. The plate material used will average 0.04 sulphur

Condensed from a paper titled "Some Results of Advances in Welding and Radiography on the Welding of Pressure Vessels," presented at the Chicago Production Show and Conference, Stevens Hotel, March, 1946.

or less. It has been shown, however, that local regions of sulphide inclusions may run as high as 0.12 to 0.15 sulphur. It is reasonable to assume that if concentrations of these inclusions are not too great, they will not give any trouble in welding but, as the unetched micrographs have shown and as most sulphur prints will indicate, these segregations may appear in plates in bands or in concentrations. When areas of this type are contacted by the heat of welding the concentration of sulphur is often more than can be taken care of by the process, and the cracking trouble which has been described takes place.

If a method could be found which would show in a nondestructive manner the condition of a plate with respect to segregation concentration or banding prior to welding, many hours of repair work and welding trouble could be avoided. For the past few years we have been investigating testing methods which might serve this purpose. Magnetic tests of plate edges were first tried. Indications obtained were correlated to X-ray results but the relationship was found to be too indefinite. Plate edges were carefully polished and etched and the subsequent examination compared to radiographs made following welding of the plate but without success. Deep etching and localized fusion of the plate edges by means of an acetylene torch failed to give results. A black light or the Zyglo method was no more successful.

Sperry Reflectoscope

During December of last year my company secured a new instrument for nondestructive testing which we believe may enable us to study successfully the edges of plates and to obtain at least a qualitative indication of the concentration of segregations along the welding edge. Our experience with it of course is limited and we would not care to state a final conclusion as to what may develop from this work. We can say, however, that the work accomplished to date is encouraging. I believe those who have encountered plate defects such as have been described will agree that a method for the evaluation of them is worth while.

The instrument I refer to is the Sperry Supersonic Reflectoscope. Many applications were made of its principles during the war. *Fig. 1* gives the principle of operation of the machine: to send supersonic vibrations through the material being tested and to measure the length of time required for these to penetrate it, reflect from the opposite side, and return to their starting point. By taking advantage of the facts —that high frequency sound travels in a straight line, that it is reflected or absorbed by certain physical variations in a material, and that it is transmitted at a certain fixed rate, depending upon the material—it is possible to record the action of the sound on an oscilloscope and by a visual observation obtain an indication of the presence and location of a defect.

Description

The instrument consists of the proper high frequency oscillator and amplifier. The oscillator may be tuned over a range of frequencies of from 1 to 11 megacycles. The output of the oscillator circuit is applied to the faces of a quartz crystal ground to thickness suitable for the frequency desired. A quartz crystal has a piezoelectric property which causes it to "grow" when a difference in electrical potential is applied to its faces. If this voltage is applied at a high frequency the crystal will vibrate accordingly, producing high-frequency sound waves. The reverse is also true: when a high-frequency sound vibration is applied to the crystal a small difference of potential appears on its faces which, if amplified and placed on an oscilloscope, will indicate its response.

The instrument is being used very successfully for testing billets, forgings, shafts and similar objects for defects. A fully laminated plate gives a very clear and accurate indication. For some weld defects it is very satisfactory but, when complete examination of the weld is to be made, obtaining a satisfactory surface condition is a problem. Defects of very small thickness which, for example, are perpendicular to an X-ray beam, such as a tight lamination, flakes, etc., are easily shown. Many other applications may be cited which are of equal importance and for which the instrument gives satisfactory results.

Disadvantages

There are certain disadvantages which require experience in operation, prevent some applications, and require skill for interpretation. Surface preparation is usually a problem for surfaces must be reasonably smooth and flat. Oil must be used to assure contact of the crystal to the material so the best position for the work is flat. The wave diagram, while easily interpreted for gross flaws, will require some degree of skill and experience when small defects and conditions are being studied. Curved surfaces cannot be readily examined without grinding crystals to suit.

The sound beam being transmitted into the material has several characteristics which need to be understood in connection with the use of the Reflectoscope for the disclosure of plate conditions such as laminations and segregations. It is transmitted into the material at a fixed frequency or wave length. The area covered by the beam is approximately equal to the area of the crystal. The sound travels in approximately straight lines except for the scattering and the off-reflections which may occur. In a similar manner in which X-rays are more penetrating at short wave lengths, the sound beam is more penetrating at higher frequencies. The higher frequencies, being shorter in wave length, are more likely to be disturbed by smaller defects. Due to practical reasons such as surface conditions, 5-megacycle frequencies have been found the most satisfactory for our purpose.

The crystal size used may be one which is ½ x ½ in. or 1 x 1 in. Since the sound travels in a straight line, an inspection at one location of the crystal covers a volume in the plate which has a depth equal to the plate thickness and a sectional area equal to the crystal area.

Fall Meeting October 11 Planned by CNGA Men

"Topics on which the industry most urgently needs information" will be discussed at the fall meeting of the California Natural Gasoline Association, to be held Oct. 11 at the Ambassador hotel in Los Angeles, according to an announcement by Program Chairman Ed Ragatz, Bechtel Bros.-McCone Co.

Dr. B. H. Sage, California Institute of Technology, will open the meeting with a presentation of data and methods which natural gasoline plant designers and process engineers can use to predict accurately the thermodynamic properties of hydrocarbons. C. D. Gard and Hugh Colvin of the Union Oil Co. will discuss the economics of liquified petroleum gas operations from the manufacturers' viewpoint. The final paper in this session will evaluate the methods available for processing absorption plant rich oil.

In the afternoon, following CNGA President Kibre's address, Frank West, of the engineering firm of West & Cole, will talk on the selection of absorption pressures for plants to be installed in high pressure fields. Natural gas conversion by the Fischer-Tropsch process will be discussed by R. C. Alden of Phillips Petroleum Co.

Dealer Cooperation and Appliance Standardization

In which a three-way agreement aimed at placing the dealer on a satisfactorily competitive and mutually profitable merchandising basis with the utility is advanced. Presented with a plea for standardization of appliances as a necessary adjunct.

By S. B. SEVERSON

President, Dominion Natural Gas Co., Ltd., and Republic Light, Heat & Power Co., Inc.

Part 1. COOPERATION

IN the early days of the gas business on this continent and up to 1900, or thereabouts, all gas burning appliances, including lighting fixtures, were sold and installed mostly by plumbers, specialty dealers, and hardware stores. These appliances were poorly designed, unattractive, and inefficient. All the complaints arising from their use were attributed to the gas furnished by the gas companies rather than to the appliance itself or its installation.

To overcome this unfavorable condition, to improve customer relations, and to stimulate greater demand for their product, the gas companies were faced with the necessity of inaugurating their own merchandising policies. Sales departments were started and developed to a high degree with such excellent results that manufacturers of gas appliances were encouraged to cooperate in perfecting their appliances to meet the increased demands. As a result today we have the modern CP range and the highly developed automatic water heaters, room heaters, furnaces, refrigerators, to say nothing of industrial equipment. All of these are in satisfactory use by millions of gas customers.

Neglected Businessmen

Today there is no question as to the ability of our sales departments to sell our product. This fact, together with the efficient efforts of our production and service departments, should make our business secure. On the other hand, we have perhaps neglected the business people in our communities too long and as a result have sacrificed much good will since they could not compete with us because our sales activities were so intensive, our prices so low and our terms so liberal.

The electric companies, on the other hand, have cooperated with these business people and because of more kinds of appliances and of the very large manufacturing companies making these appliances, favorable merchandising programs and sales resulted. The large manufacturing companies have been of tremendous assistance to electric companies and business people through their national and local advertising and through the thousands of such outlets in communities. This electric competition is very real and damaging to the gas companies and therefore all the possible outlets for sales of gas appliances should be encouraged. I am sure that we will have much good will if our business friends on Main Street get the opportunity to sell gas appliances in a profitable way.

COORDINATION OF EFFORT, not handouts to dealers, is Mr. Severson's theme in outlining a workable program for dealer cooperation. The responsibility in making the marketing of gas appliances profitable to all concerned is one that all concerned must share. With this philosophy as a basis, his company, the Republic Light, Heat & Power Co., Inc., has devised a plan to assure mutual profits to dealer, utility, and appliance manufacturer. It's a plan, too, designed to strengthen the gas forces in the battle of the fuels.

Hand in hand with cooperation there must be greater stress laid upon standardization of appliances. Standardization will help dealers, build good will, and reduce manufacturer costs and utility service costs.

The author has had broad training in the utilities fields. A graduate of the University of Wisconsin, he has had engineering and management experience in various gas, electric, water, railroad, and oil properties for Cities Service Co. As president of two companies he manages distribution of manufactured and natural gas to Ontario and Western New York users; he is a director and officer of other Cities Service subsidiaries and of the Natural Gas and Petroleum Association of Canada; he has served as director of the Canadian Gas Association, before whose June meeting this paper was presented.

Many Dealer Plans

Many gas companies in the years prior to the war saw the need of a policy whereby dealers could be brought into their sales program either in part or by handling the entire sales of appliances. The results at that time were encouraging, especially where well developed programs were followed. During the war period many companies gave serious consideration to dealer cooperation and participation, as is evidenced by the large number of dealer plans now being used and developed in the postwar period. This present period is an opportune time to revitalize our sales policies with emphasis on dealer cooperation and participation since most companies have entirely eliminated or greatly reduced their sales departments during the war years. Careful and extensive studies have been made by many companies of dealer plans and many of these have been made available to the industry. Since the best and most effective work in any endeavor is done by that interest having most at stake, it will be necessary for the gas company to be assured that new and up-to-the-minute appliances are available to satisfy the customers' desires and demands.

Since dealers are primarily interested in profits and not in the appliance or the fuel which it uses, the company must create conditions that will promote gas burning appliance sales. These favorable conditions can be created by various means—through advertising, sales assistance, sales programs, educational programs, financing dealer paper, and other helps. The gas company must set the standard for the appliances that are promoted and at the same time make it possible for the dealer to obtain attractive profits through the sale of these modern, high grade, attractive, and efficient gas appliances.

"Handout" Not Wanted

In many of the so-called "dealer plans" in the past, the companies put forth most of the effort while the dealers secured what amounted to a "handout." This kind of a plan is a mistake and should be discouraged. Any dealer plan must be mutually profitable and acceptable to both parties since each party acquires new responsibilities, the acceptance of which must be obligatory if the plan is to succeed. The best plans will offer all dealers opportunity for profits through their own efforts and as such should produce healthy competition among them. At the same time, the gas companies should always be in a position to enter actively into the picture to create customer acceptance of modern appliances that will meet all competition.

Wartime Survey Made

During the war years our company made a careful survey of many dealer plans and as a result of such study has formulated a plan we believe to be best suited for our purpose and conditions. At the same time a careful survey was made to determine the preference of our customers as to kinds of fuel and what appliances they intended to buy in the immediate postwar period. This customer survey showed a large majority were more favorable to gas than to electricity, undoubtedly because of our intensive and successful CP range promotion stressing the modernity of gas. It also revealed that the automatic gas water heater had almost universal appeal over electricity, undoubtedly due to superiority in operating costs, volume, and fast recovery.

Gas Refrigerating Appeals

It showed that while gas refrigeration is still in its infancy, it has big appeal. On the other hand, gas home heating is so attractive and desired that the gas companies may find the demands caused by this service a real headache.

We also made a prospective dealer survey and found great willingness on the part of specialty dealers, plumbers, hardware, and furniture merchants to join with us in appliance selling. They were enthusiastic about the profit possibilities in these appliances and we were greatly encouraged by their interest in our suggestion for meetings stressing sales training and instruction for installation and service to customers. It is confidently believed by us that the more help we give dealers the more gas appliances will be sold and the more dealers will become more gas-minded.

Financial Aid Needed

Some dealers may be able to finance their own activities but since many, especially plumbers and smaller dealers, may not be so fortunate, arrangements can be made whereby credit corporations finance dealers' paper and stock. At the present time there are several such corporations that are in the field for this business.

As I stated above, our company has given careful consideration to dealer plans and I give you herewith some of the essential features of our plan.

Dealer Cooperation Plan

of The Republic Light, Heat & Power Co., Inc.

Table 1. Purposes, Principles, Definitions

Purpose

The purpose of the proposed dealer cooperation program is:

a) To create and maintain mutual understanding between gas appliance dealers, gas appliance manufacturers, and the gas company.

b) To promote and sell modern gas appliances that will render a safe, dependable, and highly satisfactory service.

c) To invite participation by appliance dealers in active merchandising of modern gas appliances.

Basic Principles

a) It is a responsibility of the gas company to protect its investment by maintaining and increasing public acceptance of gas as a modern fuel by a sales promotion program, which includes: An appliance sales force of its own, a cooperating dealer plan, an advertising program, and home service personnel for customer guidance.

b) Maintaining and increasing public acceptance for gas can only be achieved through the sale and installation of gas appliances that properly interpret its modernity and convenience. It includes developing new use market, such as incineration, laundry drying, all-year-round air conditioning, promotion of "New Freedom" kitchens, etc.

c) Gas ranges, automatic gas water heaters, and gas refrigerators enjoy wide public acceptance, and are items which dealers can readily sell.

d) The dealer should obtain a satisfactory merchandising profit on the sale of gas appliances. It must be as profitable for him to sell gas appliances as similar competitive appliances.

e) Gas company sales activities and salesmen's compensation in relation to dealer sales should be designed to promote harmony between dealer and gas company salesmen.

Definitions

1. *A Cooperating Gas Appliance Dealer* is one who acquires his gas appliances direct from a manufacturer or wholesaler other than the gas company; agrees to the conditions outlined in this program and plans actively to merchandise one or more kinds of approved gas appliances.

2. *A Participating Dealer* is one who acquires his gas appliances from the gas company at wholesale; agrees to the conditions outlined in this program and plans to merchandise actively one or more kinds of approved gas appliances.

3. *A Commissioned Dealer* is one not fully established and who sells appliances occasionally for the gas company on a commission basis.

4. An approved gas appliance is one which is approved by the American Gas Association and the gas company.

Continued

Part 2. STANDARDIZATION

TODAY trade journals, conference committees, and association conventions are all publicizing dealer participation plans. It is apparent that many gas companies in the postwar period plan to include in their sales programs the business people in their communities. From now on thousands of dealers are going to participate in the selling and installing of gas appliances. It will become increasingly desirable, therefore, that the closest cooperation exist between the gas companies, the manufacturers and the dealers. Such cooperation should, as in the past, produce many evolutionary changes and improvements. Such changes and improvements may well be brought about in the simplification and standardization of gas burning appliances which will reduce costs to the manufacturer, attain greater acceptance and satisfaction for the customer and lessen the need for expensive service by the gas company.

This brings me to the crux of the subject, "standardization." By "standardization" I do not mean that all ranges, water heaters and other appliances should be exactly alike in color, design and detail, but rather each one should be a complete appliance, ready for full satisfying performance to the customer. As an illustration of what I mean by a complete appliance, I can think of no better example than an automobile.

Automobiles An Example

There was a time, you will remember, when automobiles were made and sold which compared with the present day stream-lined cars were only partially complete. No one dare say that those "jalopies" were giving complete satisfaction, since whenever a customer purchased an automobile, it was necessary for him to install many accessories such as Klaxon horns, bumpers, windshield wipers, spare tire, mirrors, and the like, to meet his desires. As new models came from the production line, year after year, these and other accessories were gradually added until today we have the complete machine which gives us so much satisfaction in ownership and performance.

To further illustrate, even with our present wonderful paved highways, it is still necessary, for satisfactory engine performance, to use dust filters to keep the gas and oil clean since there is always enough dust in the air on the highway to make this added part essential. Likewise, travelling along these highways the automobile has to travel up and down hills as well as on smooth places, and to do this smoothly, regulation of the fuel delivered to the engine is required as well as a control of the ensuing temperatures. One could go on with this illustration but we must, I believe, agree that the complete automobile of today is an essential satisfying machine and yet, although each manufacturer has his own make with varying details, all automobiles are standard as to function and are tailored to meet the customers' desires.

Parallel of Fuel Sales

As an aftermath of this observation, while it is true no one today would regard it necessary for oil companies to sell automobiles in order to sell their products, it is equally true, as the past 25 years will show, that the tremendous demand for oil products

Dealer Cooperation Plan

Table 2. Responsibility of the Manufacturer

The manufacturer shall:

1) Recognize fully the importance of establishing dealers for the promotion and sale of approved and quality gas appliances.
2) Arrange through cooperation with the gas company to furnish his dealers with approved gas appliances that will perform a safe, dependable, and satisfactory gas service on the type of gas served.
3) Set up an active dealer program for the promotion of approved gas appliances in cooperation with the dealer - gas company program.
4) Establish dealer outlets in sufficient number to distribute effectively his product where he does not sell to the gas company.
5) Promote the sale of (1) CP ranges; (2) high quality automatic gas water heaters with a tank guarantee of five years or more; (3) gas refrigerators, and (4) other approved gas appliances.
6) Assist dealers in arranging floor displays of approved gas appliances.
7) Make available for dealers effective promotional and advertising material.
8) Cooperate with the gas company in conducting dealer educational meetings.

Dealer Cooperation Plan

Table 3. Responsibility of the Dealer

The dealer shall:

1) Purchase for resale:
   a) Approved automatic water heaters (with a tank guarantee five years or more) direct from manufacturer or distributor.
   b) Approved gas ranges direct from the manufacturer or distributor. All gas ranges retailing for $125 or more shall be CP models.
   c) Gas ranges, water heaters, and Servel gas refrigerators from the gas company where he elects to participate inthe sale of the same gas appliances as handled by the gas company.
2) Maintain an adequate showroom and display several current models of approved gas ranges and/or gas refrigerators. Display facilities will not be a requirement if only automatic gas water heaters are handled.
3) Recommend and .aggressively sell approved gas appliances.
4) Agree to accept the installation specifications set up by the gas company.
5) Arrange to provide maintenance and service during the warranty period of all approved gas appliances with the exception of gas refrigerators that he acquires from the gas company.
6) Furnish the gas company with information and reports on the sales and installation of all gas appliances.
7) Repossess gas appliances as directed by the finance company and reacquire them from the finance company where required to do so by contract with the finance company.
8) Participate in instruction on gas utilization, gas appliance installation, and sales training programs.
9) Coordinate his gas appliance advertising with the gas company, manufacturer, and distributor, wherever and whenever feasible.
10) Take an active part in seasonal gas appliance sales campaigns and tune his displays to such programs.

Continued

corner PANELRAY *installation popular*

THE corner installation of PANELRAY, the infra-red vented gas wall heater, especially in newly constructed homes, is becoming increasingly popular.

First, a corner installation often affords a wider coverage of the room area by the infra-red heat rays . . . In extra large rooms, a PANELRAY in opposite corners gives full coverage with maximum efficiency and flexibility.

Second, such an installation uses space that would otherwise be wasted, allowing greater freedom in the placement of furniture in front of unobstructed walls.

DAY & NIGHT

DAY & NIGHT MANUFACTURING COMPANY
MONROVIA, CALIFORNIA
One of the Dresser Industries

has closely paralleled the tremendous advance in automobile use, design and performance. So likewise, the future of our sales both in appliance and service will be dependent upon the way in which we design our appliances to meet our customers' complete desires.

I am sure we can do this if the gas companies and manufacturers cooperate and plan for the delivery to all purchasers of a complete gas appliance. As an example of a complete gas appliance, in this case a range, I refer to the recent revised specifications of the CP range requirements as presented in Chicago by Carl Sorby of the George D. Roper Corp. These specifications, which follow, are the result of 31 regional planning meetings submitted to the A.G.A. Committee on Improving Domestic Gas Appliances, and call for a CP range to:

1. Display A.G.A. Laboratories Approval Seal.
2. Be equipped with automatic time control.
3. Be of flush-to-wall construction (back and both sides).
4. Have automatic oven ignition.
5. Have oven heat control.
6. Direct flue products away from wall.
7. Provide quiet operation of all drawers without undue friction or jamming.
8. Have effective stops on racks and drawers.
9. Have effective smokeless-type broiler pan.
10. Have automatic broiler ignition.
11. Provide 80% of grill area at minimum effective broiling area.
12. Have dual or high-low type top burners.
13. Have one or more giant top burners.
14. Have automatic top lighters.
15. Provide rust resisting top burner heads.
16. Have ovens capable of cooking or food processing at temperatures as low as 250° F.
17. Possess top burner efficiencies of not less than 45%.

To these requirements I believe should be added, as in the case of the automobile illustration, individual filters and regulators: the filter to make sure that dust particles and gum carried by the gas do not interfere with the proper burning of the pilots, and the regulator to insure the constant pressure for which the burner was designed.

I believe that all gas appliance manufacturers should equip all models of ranges, water heaters, space heaters, gas furnaces and refrigerators with pilot filter and individual regulator. This seems particularly important now as we plan to embark on dealer participation plans, since dealers will not voluntarily install these accessories essential to complete customer satisfaction.

If manufacturers, gas companies, and dealers will cooperate in this respect I am sure much benefit will accrue to all of them. It may appear as a selfish interest of the gas company to ask that filter and regulator be added, since thereby service expenses will be reduced; but we all must remember that in the end our customers' acceptance and satisfaction, which must be our primary concern if we are to stay in business, is dependent upon the installation of a complete and perfectly operating appliance.

This paper does not pretend to cover all details but I recommend closer cooperation between gas companies and manufacturers in order that we may produce the desired results. I feel sure this can and will be done, and that one of the greatest factors which can contribute to it is simplification and standardization.

DEALER COOPERATION PLAN

Table 4. Responsibility of the Gas Company

The gas company shall:

1) Help the manufacturer, distributor, or dealer in the preparation of required specifications on gas appliances for their safe, satisfactory, and economical operation on the type of gas served. Such appliances bearing the A.G.A. laboratory seal will be considered as approved as long as they render the above described service.

2) Assist the manufacturer and distributor in establishing dealers for approved gas appliances.

3) Provide certain participating dealers at wholesale price the same line of gas ranges, water heaters, and refrigerators that the gas company sells.

4) Promote the use of gas through the sale of approved gas appliances at a price level that will permit a dealer to compete and make a normal profit.

5) Compensate its salesmen to invite and not discourage dealer sales of approved gas appliances.

6) Protect the "participating" dealer on his gas appliance prospects for a specified period as far as gas company sales are concerned.

7) Establish in its organization, personnel to assist dealers in promotion and sale of approved gas appliances.

8) Assist dealers in obtaining comparable facilities with those in effect by the gas company for:
   a) Financing time payment sales of approved gas appliances by "cooperating," "participating" and "commissioned" dealers with monthly payments paid at the gas office.
   b) Financing gas appliance displays for "participating" dealers.
   c) Delivery and installation of gas appliances by another installer.

9) Furnish necessary inspection of gas equipment sold and installed under dealer contract.

10) Furnish without charge gas pressure regulators to dealers for all gas ranges sold and installed on its lines, until regulators are furnished by manufacturers with the appliance.

11) Give a commission of not more than 15% to commissioned dealers who are not qualified as fully established dealers but who occasionally sell gas appliances as part of their regular business.

12) Provide without charge to dealer or customer, maintenance and service during the warranty period on gas refrigerators sold by the gas company to the dealer.

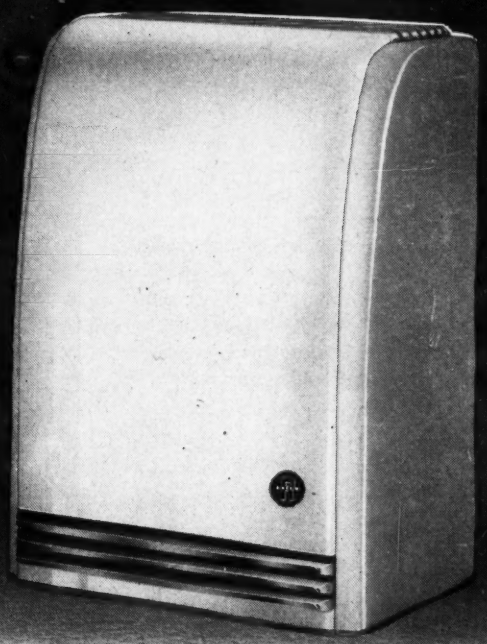
13) Coordinate advertising and promotional sales activities to include dealer participation wherever and whenever feasible.

14) Supply "cooperating" and "participating" dealers, without charge, placques or other suitable means for identifying them as "cooperative gas appliance dealers" for the gas company.

15) Conduct a gas utilization and sales training program for the dealer and his personnel.

16) Assist in educating dealers' employees regarding the proper installation of approved gas appliances.

LET BEAUTY BUILD YOUR HEATER SALES



New RHEEM gas console heater

Women customers will like the simple gracious lines of this Rheem gas console heater. Its handsome antique finish brings new beauty to any interior. Tall functional design increases heat circulation and requires less floor space. Narrow base of heater permits installation on strip between wall and rug.

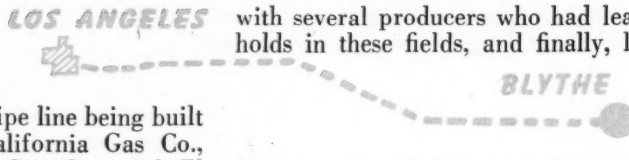
Sales are easy because the low price and economical operation fit any budget. Approved by American Gas Association, whether vented or unvented. Available in three popular sizes: 25,000; 35,000; 50,000 B.T.U. Get full information today. Write Rheem, 570 Lexington Avenue, New York 22, New York.

RHEEM... *making houses into homes*

RHEEM

BUILDING THE TEXAS—TO

The Sources, The Pipe, The Market, The Costs



THE 1200-mile pipe line being built by Southern California Gas Co., Southern Counties Gas Co., and El Paso Natural Gas Co. for the transportation of 300 MMcf of gas daily from Texas to Southern California, is a project which has provoked many questions. One of the most frequently mentioned is relative to the need for such a costly undertaking, in view of the large known reserves of gas in California. The decision to build this line was reached only after much study and analysis, and some unavoidable crystal-gazing. It required the resolving of many economic and engineering problems, and the job of building it is yet to be done.

In the fall of 1943, after careful study of expected supply vs. demand trends, the conclusion was reached that there are within the state of California no known long-lived, dependable and economical sources of natural gas which would afford a means of augmenting our existing supply, and therefore it had become vitally necessary that we seek and obtain without delay a major out-of-state source.

Possible Sources

That brought us to the first problem: What are the optimum midcontinent sources for this market?

A survey of the known adequate reserves, within economic range of pipe line transportation, quickly narrowed down to the Hugoton-Panhandle fields and those of the so-called Permian Basin. Over a period of about two years we carried on a careful and comprehensive investigation of possible projects. We employed geologists to survey the reserves and prospective rates of availability for the producing areas mentioned, conducted extensive map and field reconnaissance of possible routes, and designed and made estimates of capital and operating expenses for a number of tentative projects to transmit gas from Hugoton-Panhandle and from Permian Basin, both separately and in combination.

We carried on extended negotiations with several producers who had leaseholds in these fields, and finally, last summer, entered into a contract with the El Paso Natural Gas Co. to buy gas at the Colorado river obtained from both of these important sources. We are, of course, seeking a long-lived source, and experts who have made a most comprehensive investigation of these fields are satisfied that the reserves and contract rights supporting our project will insure meeting the draft requirements for a period of 30 years, which is the term of the contract.

Market Outlet Provided

The Hugoton and Panhandle dry gas fields, which cover parts of Texas, Oklahoma, and Kansas, together comprise the largest known gas reserve in the world, with estimated recoverable gas of approximately 40 trillions of cu. ft. and a proven area exceeding 4,200,000 acres. The Permian Basin, in West Texas and New Mexico, is a vast producing region spotted with many oil fields, the major portion of the gas being produced in conjunction with oil. For lack of a market nearly 400 MMcf per day of raw and residue oilwell gas is now wasting at wells and gasoline plants.

The market outlet which our pipe line will provide affords a means of utilizing large volumes of Permian Basin gas which otherwise would continue to be vented to the air, while the dry gas reserves and controllable deliverability of Hugoton-Panhandle will insure the supply continuity and long life which are vitally necessary to make a project of this magnitude feasible. The conservation of Permian Basin gas was one of the important factors which influenced the FPC to act favorably upon our certificate application. The pipe line itself will convey this gas from well to customer.

Past technological developments have made it possible to design and build a line such as this one. Long-distance, high-pressure transmission of natural gas as we now know it, had its inception in 1927. The factor which made the industry, as it now exists, possible, was the application in that year of new welding technique to the volume production of large diameter steel pipe. The greater diameters, higher stresses, and higher pressures which such pipe permitted, extended the economically feasible range of gas transmission from about 150 miles to the 1300 miles now employed.

Prior to that time there was available to the pipe line designer only lap-weld pipe, with approximately the following average physical properties for the finished tube: Net transverse strengths including seam—yield 28,000 psi; ultimate tensile 44,000 psi. Efficiency of longitudinal seam — 80%. With this product a designed working stress of about 12,000 psi was considered good engineering practice.

The electric-welded pipe now available has the following properties:

	Average	Minimum
Transverse yield point	61,000 psi	52,000 psi
Transverse ultimate tensile strength	86,000 psi	72,000 psi
Seam efficiency		100%

Thus, both the net yield and ultimate strengths have approximately doubled; but even more important, the dependability of the longitudinal weld has greatly improved. Recently, large diameter thin-wall seamless pipe has been made available which almost matches the physical specifications and per-foot cost of electric weld pipe.

Code for Pressure Piping

As a result of the foregoing changes in specifications, and based on experience gained in the use of pipe fabricated from plates by electric welding, the "Code for Pressure Piping" now permits a working stress in rural territory equal to 72% of the specified or demonstrated yield strength. Under this code, stresses as high as 39,500 psi have been employed, corresponding to a minimum specified yield strength of 55,000 psi. Thus, the working stresses customarily used in pipe line design have trebled in the past 20 years.

Concurrently, advances have been made in the design of gas-engine-driven compressors, thus reducing both capital and operating costs of such units.

Essential elements of a typical modern gas pipe line project comprise:

T-CALIFORNIA LINE

By A. F. BRIDGE

Vice President and General Manager, Southern Counties Gas Co., Los Angeles

A shortened version of the paper presented by the author before the PCGA convention, San Francisco, Sept. 11, 1946.

1) Field collection systems in each tributary field.

2) Field compressor stations in which the gas is processed for recovery of heavy fractions and the removal of hydrogen sulfide, if present, is dehydrated, and compressed to mainline pressure.

3) The main pipe line.

4) A series of mainline compressor stations located at intervals of 60 to 200 miles.

The optimum compression ratio for present-day booster stations lies in the range of 1.3 - 1.8.

El Paso Natural Gas Co. will build and operate that part of the project in Texas, New Mexico and Arizona, and sell gas to Southern California Gas Co. and Southern Counties Gas Co. at Blythe, Calif. El Paso's pipe line design is based upon an ultimate maximum delivery of 305 MMcf per day. For the 737 miles between the Arizona-California border and the Eunice compressor station in New Mexico, 26-in. diameter pipe will be used, and the 251-mile extension, scheduled for the second year, from Eunice to Dumas in the Texas Panhandle, will be of 24-in. diameter. The compressor stations will have total installed primary horsepower of 31,000, 45,000 and 130,000 respectively, for three stages of development. Estimated cost of El Paso's part of the ultimate project is approximately $54 million.

The California companies' 214-mile connecting pipe line from the Arizona-California border to Santa Fe Springs, N. Mex., will be 30-in. in diameter. A main line compressor station of 10,000 hp. will be installed at Blythe, as well as pressure-limiting stations, lateral lines, and appurtenant facilities. The estimated capital cost of the California section at ultimate capacity is $16,225,000.

The total length of the main pipe line, consisting of 24-, 26- and 30-in. pipe, from Dumas to Los Angeles, will be approximately 1212 miles, and the total project cost over $70 million.

The integrated pipe line project is planned for three progressive stages of capacity, with gas deliveries by the El Paso Natural Gas Co. to the California companies at the Arizona - California border to begin in the fall of 1947, and to continue for 30 years. The contract requires the California companies to take gas at a minimum annual load factor of 91%. The maximum contracted volumes to be delivered by El Paso are 125 MMcf per day the first year, 175 MMcf per day the second, third and fourth years, and 305 MMcf per day the fifth and succeeding years. Construction of the final stage is conditioned upon an election by the California companies prior to Sept. 1, 1949.

Most of the design factors are common to both sections of the line. For the final stage, El Paso will have six field stations and six booster stations, with an aggregate rated horsepower of 130,000. Total compressor fuel consumption, including our Blythe station, will be about 35 MMcf per day, or 10.4% of input to field stations. El Paso's booster station spacing will average about 100 miles, compression ratios will range from 1.52 to 1.6, and pipe line operating pressures at station outlets will be 780 - 820 psi. Maximum design stress will be 36,600 psi.

California Section Design

The designed working stresses for the California section of the line are 35,000 psi in sparsely settled areas, and 25,000 in populous territory and on, or adjacent to, roads and railroads. Judged by present-day practice in the industry, they are conservative standards. These stresses may be compared with our specified minimum transverse strengths for the finished pipe (including the seam) as follows: yield—52,000 psi; ultimate—72,000 psi.

This part of the project has three unusual features. These are (1) its diameter—30-in. O.D.; (2) the use of pressure-limiting stations; and (3) a design which makes available approximately 52 MMcf of storage at relatively low cost.

The original design called for 26-in. O.D. pipe, the largest which has been employed in other gas transmission lines, and the largest obtainable from Eastern pipe mills. Following negotiations, Consolidated Steel Corp. of Los Angeles undertook to manufacture 30-in. pipe to our specifications, and we awarded them a contract for some 60,000 tons. This job represents the first fabrication of large diameter, high-strength pipe on the Pacific Coast, and this manufacturer deserves commendation for pioneering in this field.

Among the features which led us to adopt 30-in. instead of 26-in. were:

1) Reduction in required compressor horsepower, resulting in annual fuel savings of about $64,000, and increased net terminal delivery capacity.

2) Possibility that capacity of the line might later be increased to 400 MMcf per day, in which case 30-in. would effect additional annual savings of $200,000.

3) Following completion of this order, the local manufacturer will be in a favorable competitive position to supply any future orders for large-diameter, high-strength pipe.

At the quoted pipe prices there was no significant difference in the overall initial capital cost of the project as between 26-in. and 30-in., since the higher unit cost of 30-in. pipe was offset by the saving in compressor horsepower.

Pipe Fabricating Process

The pipe is being fabricated in a newly-installed production line in the Maywood plant of Consolidated Steel. The fabrication process is new to the West Coast in that it embodies continuous welding of the longitudinal seams and hydraulic expansion of the welded pipe sections.

The steps involved in processing the pipe from flat plate to finished section are shown in *Fig. 1*. Plates of special manganese steel 30 ft. in length are passed on a conveyor through *Leveling Rolls A*, which remove any waves or buckles, *Shear B*, which trims the ends square and to proper length, and *Grit-Blaster C*, which removes mill scale from the edges to be welded, to *Planers D*, which reduce the plate to exact width and squareness and properly prepare both edges for welding.

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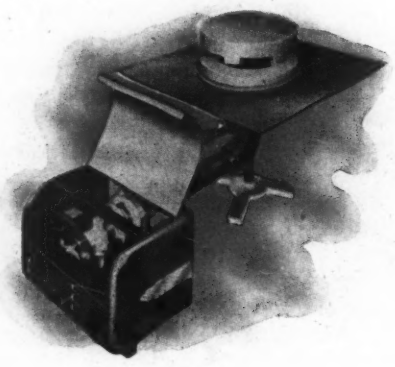
- A self-igniting automatic safety pilot.



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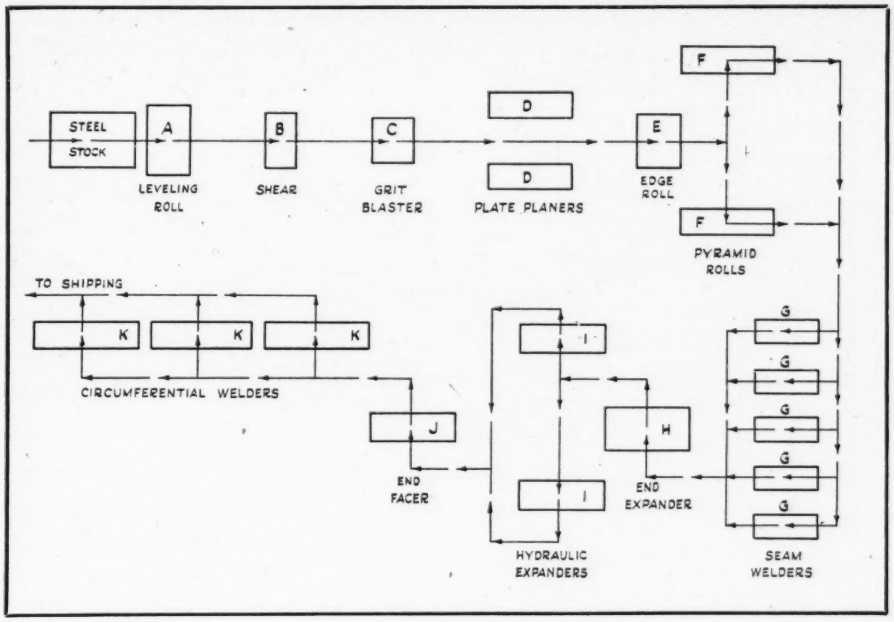


Fig. 1. Steps involved in processing pipe from flat plate to finished section.

The plates are then conveyed to the *Edge Roll E*, which forms both edges to the proper radius, and thence to one of two *Pyramid Rolls F*, in which the plates are rolled to cylindrical shape. Upon leaving the roll, the cylinders are fed end to end through the *Seam Welders G*, in which the abutting edges are properly aligned and welded from the outside by submerged arc process.

In this process the edges are progressively fused together by means of a heat generated by the passage of a heavy electric current between a bare welding electrode and the plate. The electrode is not in actual contact with the work, but the current is carried across the gap through a granular material, or "melt," which is laid down along the seam just ahead of the electrode and in which the end of the electrode is submerged. The entire welding action takes place beneath the granular material without visible evidence such as flash, sparks, or spatter. The resulting weld is smooth in appearance, completely penetrates the plate, and possesses greater strength than the parent plate.

Expansion Operation

The cylinders at this stage are somewhat smaller in diameter than the finished outside dimension of 30-in. In the next operation the ends of the cylinders are mechanically stretched in the *End Expander H* to 30-in. diameter, after which they are rolled into one of the *Hydraulic Expanders I*. In this machine the pipe section, which is 30-in. diamteer only at its ends, is placed between movable heads and surrounded by a cylindrical die of 30-in. inside diameter. The pipe section is filled with water, and sufficient pressure applied to stretch the pipe until it contacts the die.

The purposes of the expansion operation are several. First, the "cold working" of the steel materially increases its yield strength. Second, the expansion of the pipe into the cylindrical die produces uniform roundness and straightness. Third, the operation fully tests the strength of the welded seam at the yield strength of the parent plate.

After the pipe section is expanded, the internal pressure is reduced to a specified test pressure, the die is removed, and the weld is hammer tested and examined for leaks. Incidentally, the expansion of the pipe results in shortening of the 30-ft. section by several inches.

From the expanders the pipe sections are conveyed to the *End Facer J* and thence to the *Circumferential Welders K*, where two 30-ft. sections are welded together into a 60-ft. shipping section. The circumferential seam also is made by the submerged arc process.

The sections are then ready for coating and shipping to the job.

Throughout the process, from the making of the steel at the mills to the acceptance of the pipe for shipment, careful records, tests, and checks are made to insure the quality and uniformity of the product.

The weight of steel in the 214 miles of pipe is approximately 60,000 tons, and the scheduled production rate at the Maywood plant is 9 miles per week, or about one 30-ft. section every 4¼ minutes.

Pressure Gradient

Fig. 2 shows the pressure gradient along the California section under various conditions of flow. This illustrates and explains the other two design features previously mentioned—storage and pressure limitation.

For the final capacity stage (305 MMcf), shown by the upper pressure gradient, the maximum discharge pressure at the Blythe section will be 810 psi, requiring a wall thickness of 11/32-in. for a 35,000 psi stress. The closing of a valve at any point downstream from the compressor station, would subject the intervening section to this pressure; hence, if we did not employ pressure-limiting stations, the entire line would have to be 11/32-in. wall, except where it must be correspondingly heavier for those sections designed for 25,000 psi stress.

By introducing three pressure-limiting stations, as shown, we are enabled to graduate the wall thickness down to 9/32-in., thus saving some 7400 tons of steel, and about $600,000 in capital.

Each pressure-limiting station will be located at a mainline valve station, and will consist of several gas pressure-reducing regulators, operating in parallel in a by-pass around the mainline valve. During periods of low flow, the main line valve in each station will close automatically, and all gas will pass through the regulators, which will limit the downstream pressure to the designed maximum. When the rate of flow increases beyond the combined capacity of the regulators, the main line valves will open automatically. Relief valves will be installed at each station as secondary protection for the downstream section.

This graduated wall thickness design has been successfully employed by our company since 1931 on several major lines, but to my knowledge has been neither publicized nor adopted elsewhere. Obviously its employment should be limited to transmission lines where flow is certain to be unidirectional throughout the project life.

Main line valve stations will be installed at about 10-mile intervals where the line is located on private rights-of-way in desert country, and at shorter intervals where the line traverses populous territory. They will be welded into the pipe line, using 30-in. by 24-in. steel reducers, and each valve will be equipped with a piston-operated shut-off device to sectionalize the line automatically in the event of a rupture due to any cause.

Again referring to *Fig. 2*, note the upper two lines. The lower of these

shows the parabolic pressure curve corresponding to a uniform flow rate of 305 MMcf per day, requiring an initial pressure at Blythe of only 675 psi to give a terminal pressure at Santa Fe Springs of 250 psi. By designing the line for the higher pressure corresponding to the upper line, and adding 2700 hp. in the Blythe station to compress gas to 810 instead of 675 psi, storage capacity, in the form of line pack, is obtained at relatively low incremental cost and with no impairment of the required 24-hour deliverability of the line.

Potential Storage Volume

The area between the two 305 million curves indicates the potential volume of storage realizable under ideal conditions. The amount of storage that can actually be realized under operating conditions depends upon a number of factors, the most important being the hourly schedule of rates of flow from the line over the 24-hour period of the operating cycle.

Maximum usable storage is attained when relatively high rates of withdrawal occur during the first few hours of the unpacking period and with very low rates of withdrawal during the last few hours of the packing period.

The realizable storage under planned operating conditions is estimated to exceed 52 MMcf. This will be obtained at an added cost of $1,455,000 equivalent to $28 per Mcf or roughly one-sixth the unit cost of conventional gas storage holders. During the unpacking period, gas can be withdrawn at a sustained rate of 500 MMcf per day for two hours, tapering off to the 305 MMcf average, the excess flow being compensated for by curtailing to a 100 MMcf per day rate during off-peak night hours.

Other Specifications

The other specifications of the line follow conventional modern practice:

Internal corrosion will be prevented through dehydration by the El Paso company of the gas delivered at Blythe. External corrosion will be minimized by the use of a protective coating consisting of a coal-tar enamel —minimum thickness 3/32-in.—and a wrapper of coal-tar impregnated 15-lb. asbestos felt.

Cathodic protection will also be applied to the entire pipe line to prevent corrosion that might otherwise occur at defects in the protective coating. The cathodic protection installation will consist of eight electrical drainage stations, each one draining approximately 27 miles of line.

Bends will be made by inserting segments of weld ells, cut to fit the angular deflection and attached to the line by internal and external girth welds. It is expected that this type of construction will tend to improve the overall friction factor.

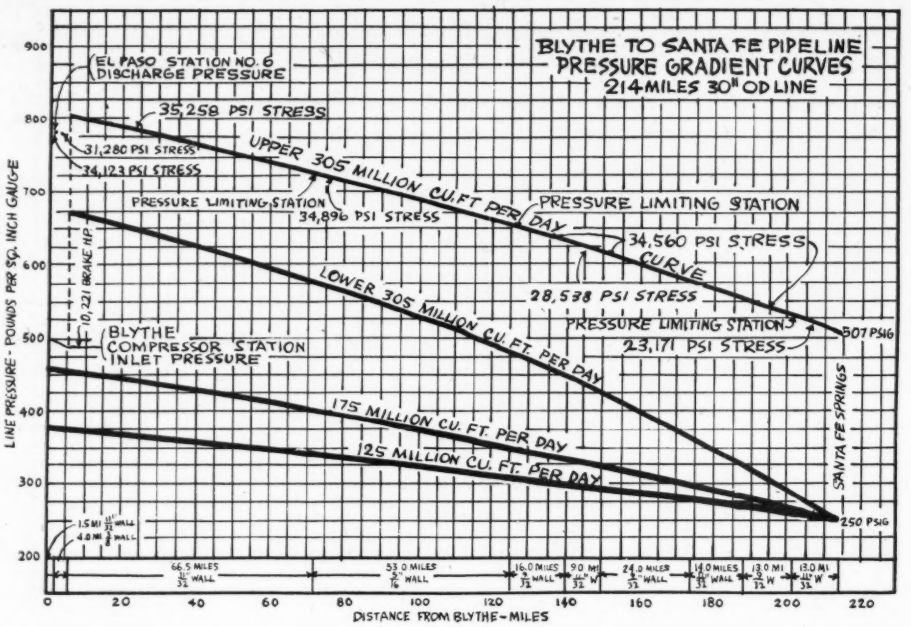

BLYTHE TO SANTA FE PIPELINE
PRESSURE GRADIENT CURVES
214 MILES 30" OD LINE
EL PASO STATION NO. 6 DISCHARGE PRESSURE
35,258 PSI STRESS
31,280 PSI STRESS
34,123 PSI STRESS
UPPER 305 MILLION CU. FT. PER DAY
PRESSURE LIMITING STATION
34,896 PSI STRESS
PRESSURE LIMITING STATION
34,560 PSI STRESS CURVE
28,538 PSI STRESS
PRESSURE LIMITING STATION
23,171 PSI STRESS
LOWER 305 MILLION CU. FT. PER DAY
10,221 BRAKE HP
BLYTHE COMPRESSOR STATION INLET PRESSURE
807 PSIG
175 MILLION CU. FT. PER DAY
125 MILLION CU. FT. PER DAY
SANTA FE SPRINGS
250 PSIG
LINE PRESSURE - POUNDS PER SQ. INCH GAUGE
DISTANCE FROM BLYTHE - MILES

Fig. 2. Pressure gradient along California section under various conditions of flow.

Service Outage Eliminated

One paramount objective in designing a gas transmission line, particularly when, as in this case, it will furnish a relatively large part of the total supply for an area, is continuity of operation. All practicable precautions must be taken to insure against accidental interruptions of pipe line flow, because to a gas man a service outage is unthinkable. This is by no means a matter of pride alone, but rather grim necessity. It is the avoidance of such a situation which causes the expenditure of many millions in capital to meet a heating peak demand which may occur only once in 5 to 7 years.

Southern California has by far the highest saturation of automatic gas appliances of any comparable area in the nation. No successful method has yet been devised for rationing or curtailing the space heating consumption of our million-odd domestic and commercial customers, and hence we know of no sure way to prevent a supply deficiency in a given area from causing an outage.

Cost of Delivered Gas

The cost of gas delivered from this project is an item of paramount importance to our companies. The average cost of gas in the field, for the initial five-year period, is approximately 4¢ per Mcf of gas delivered at the Colorado river. This figure may be compared with total unit cost of gas delivered to the Santa Fe Springs terminus, being the sum of the contract price paid El Paso plus fixed and operating costs for the California section. For the three stages of development these overall costs are as follows:

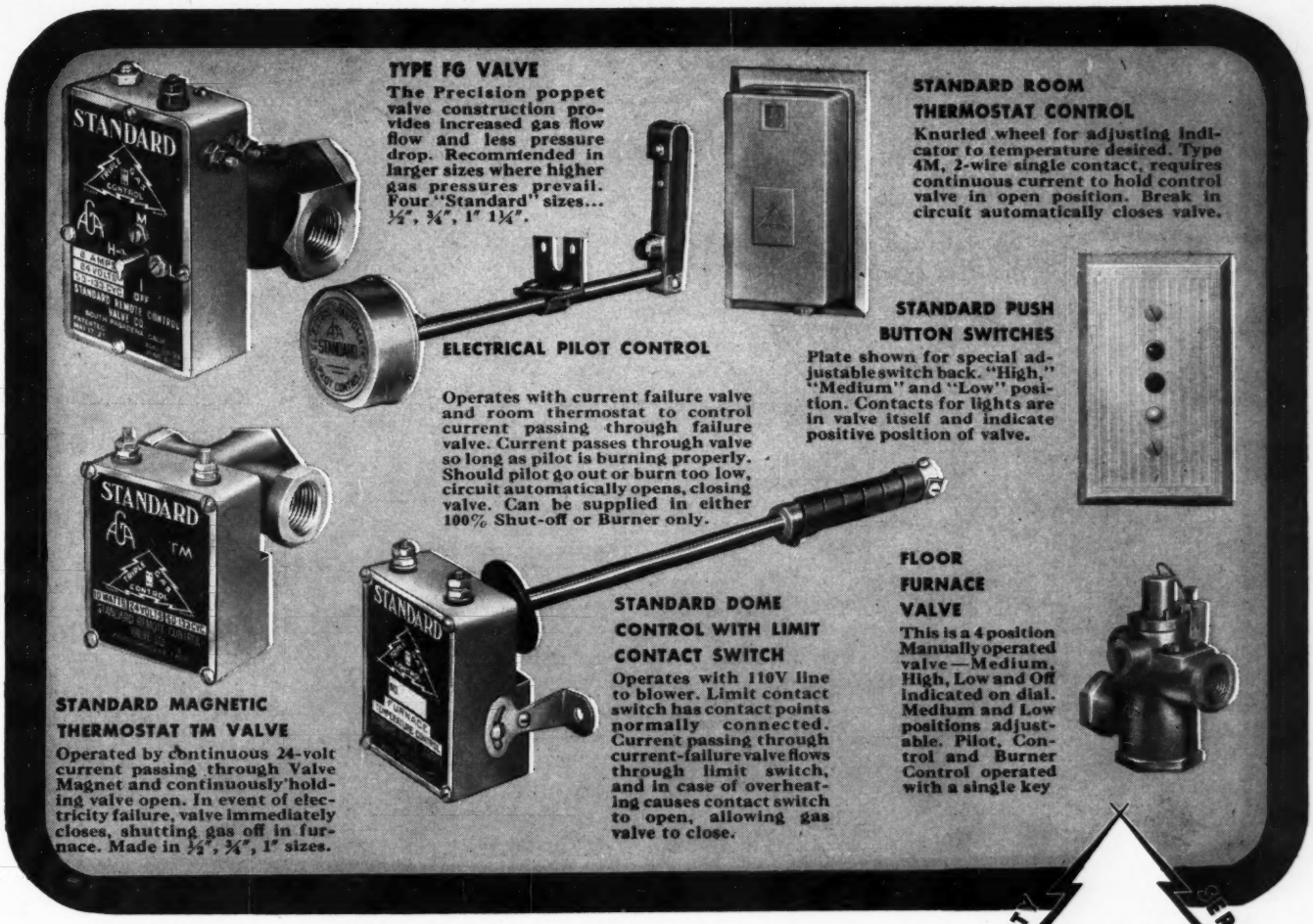
125 MMcf per day capacity (first year)	**20.3c per Mcf**
175 MMcf per day capacity (second year)	**18.1c per Mcf**
305 MMcf per day capacity (1951)	**16.5c per Mcf**

These are based upon the obligatory minimum average load factor of 91%.

Preliminaries Begun

Preliminary construction work on the El Paso company's line has been started. Grading of right-of-way, and trench excavation are under way in several mountainous sections where rock is encountered. Unavoidable delay in the delivery of electric weld pipe will be met by substitution of 228 miles of 26-in. seamless pipe of 0.303-in. wall thickness. Delivery of all compressor units is expected during 1946. The revised construction program calls for pipe line installation to start early in January, 1947, and finish about Oct. 1, 1947.

Bids have just been received covering the 214-mile California section and contracts will be awarded in the immediate future, with construction scheduled to start Jan. 1, 1947, and job completion expected about Sept. 1, 1947.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STANDARD ROOM THERMOSTAT CONTROL
Knurled wheel for adjusting indicator to temperature desired. Type 4M, 2-wire single contact, requires continuous current to hold control valve in open position. Break in circuit automatically closes valve.
STANDARD PUSH BUTTON SWITCHES
Plate shown for special adjustable switch back. "High," "Medium" and "Low" position. Contacts for lights are in valve itself and indicate positive position of valve.
ELECTRICAL PILOT CONTROL
Operates with current failure valve and room thermostat to control current passing through failure valve. Current passes through valve so long as pilot is burning properly. Should pilot go out or burn too low, circuit automatically opens, closing valve. Can be supplied in either 100% Shut-off or Burner only.
STANDARD MAGNETIC THERMOSTAT TM VALVE
Operated by continuous 24-volt current passing through Valve Magnet and continuously holding valve open. In event of electricity failure, valve immediately closes, shutting gas off in furnace. Made in ½", ¾", 1" sizes.
STANDARD DOME CONTROL WITH LIMIT CONTACT SWITCH
Operates with 110V line to blower. Limit contact switch has contact points normally connected. Current passing through current-failure valve flows through limit switch, and in case of overheating causes contact switch to open, allowing gas valve to close.
FLOOR FURNACE VALVE
This is a 4 position Manually operated valve—Medium, High, Low and Off indicated on dial. Medium and Low positions adjustable. Pilot, Control and Burner Control operated with a single key

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Solid Fuels Reserve

A study of the nation's supply and its relation to the future stocks of gaseous and liquid fuels. A paper originally presented at the Federal Power Commission's Washington Hearing in June. Reprinted as a sequel to "Natural Gas Reserves," by E. DeGolyer, which appeared in the September issue of G A S.

By ARNO C. FIELDNER,
Chief, Fuels and Explosives Branch, Bureau of Mines

THE United States is fortunate in having large reserves of all kinds of mineral fuels in solid, liquid, and gaseous forms. The coal reserves, not including Alaska, but including lignite, were estimated by the Federal Geological Survey at 3.2 trillion net tons as of January 1, 1937.[1] This amount is thought to be from 40% to 50% of the world reserves of all ranks of coal. The proved reserves of petroleum in the United States as of January 1, 1946, are estimated at 20.8 billion barrels by the Committee on Petroleum Reserves of the American Petroleum Institute.[2] This figure is about 35% of the proved world reserves.[3] The proved reserves of natural gas have been estimated at not less than 135 trillion cubic feet as of January 1, 1945, by James E. Pew of the Petroleum Administration for War.[4] Very little data are available on the world reserves of natural gas.

In addition to these fuel reserves, Winchester has estimated a potential reserve of 92 billion barrels of oil obtainable from the distillation of oil shale in the United States.[5] This amount is more than four times the present proved petroleum reserve.

Difference in Estimate

Special attention is called to an important difference between the estimates of reserves of natural gas and petroleum on the one hand, and solid fuels on the other. Only the proved reserves are given for liquid and gaseous fuels. These are increased each year by new discoveries and extensions of fields and are decreased by the year's production. Since 1940 the petroleum reserve has remained at about 20 billion barrels. During the same period the estimates of natural gas reserves have increased from 80 to 135 or more trillion cubic feet. Undoubtedly, much more oil and gas will be discovered in the United States and in this respect these fuels differ from coal and oil shale. The solid fuel reserves are estimated from geological observations and measurements of thickness and extent of deposits obtained from surface outcrops, trenching, exploratory tunnels, shafts, and drill cores. No great accuracy can be claimed for these estimates, but future exploration is not likely to add greatly to the solid fuel reserves. Some geologists believe that revisions will be downward as more detailed exploration or development data are obtained in the various fields.

All evidence points to very much larger reserves of coal than of oil and gas as shown in *Table 1*, where all the mineral fuels are expressed in equivalent tons of coal of 13,000 Btu per pound calorific value. The total of all ranks of coal amounts to approximately 2500 billions of tons of 13,000 Btu coal, whereas the proved petroleum reserve is equivalent in heating value to only 4.8 billion tons of coal and the proved natural gas reserve is equivalent to 5.2 billion tons. In other words, coal comprises 48.8% of our mineral fuel energy reserves. Oil shale amounts to 0.8%, petroleum to 0.2% and natural gas to 0.2%. While we cannot forecast further discoveries of oil and gas, it appears on the basis of present knowledge that the ultimate reserves of oil and gas will be very small as compared to the reserves of coal and lignite. As the supply of oil and natural gas declines below the demand, it will be necessary to resort to coal and other sources of energy either by direct substitution or by conversion of solid fuels to liquid and gaseous forms. Fuel gases from coal by carbonization or complete gasification have long been in commercial use, and in recent years commercial processes have been developed for the conversion of coals to liquid fuels by the direct hydrogenation of coal or hydrogenation of tars or gases produced from coal.

Various Ranks of Coal

The minimum thickness of beds included in the Geological Survey estimate of reserves is 14 in. for bituminous and anthracite coals, 2 ft. for subbituminous coal, and 3 ft. for lignite. Coal beds lying more than 3000 ft. below the surface were not included in the estimates. There is comparatively little coal in the United States that would require mining at depths beyond 3000 ft. The estimated coal reserves do not allow for losses in mining; that is, they are not limited to recoverable coal as is the case with the petroleum and natural gas estimates. In computing the life of a reserve based on an assumed annual production as given in column 7 of *Table 1*, allowance was made for 35% mining losses for anthracite and 30% for bituminous coal and lignite.

From the standpoint of regional distribution, the principal reserves are grouped in the Eastern Province, consisting of Pennsylvania, Ohio, Maryland, West Virginia, Virginia, Eastern Kentucky, Tennessee, and Alabama; the Interior Province, consisting of Illinois, Indiana, Western Kentucky (comprising the eastern region of this province) and Iowa, Missouri, Eastern Kansas, Oklahoma and Arkansas (comprising the western region); and the Northern Great Plains, Gulf, and Rocky Mountain Provinces, extending from North Dakota and Montana through Wyoming, Colorado, Utah and New Mexico and including Texas. The reserves of these provinces are summarized in *Table 2*.

Only one-third of the total tonnage of coal and lignite reserves occurs in the Eastern and Interior Provinces.

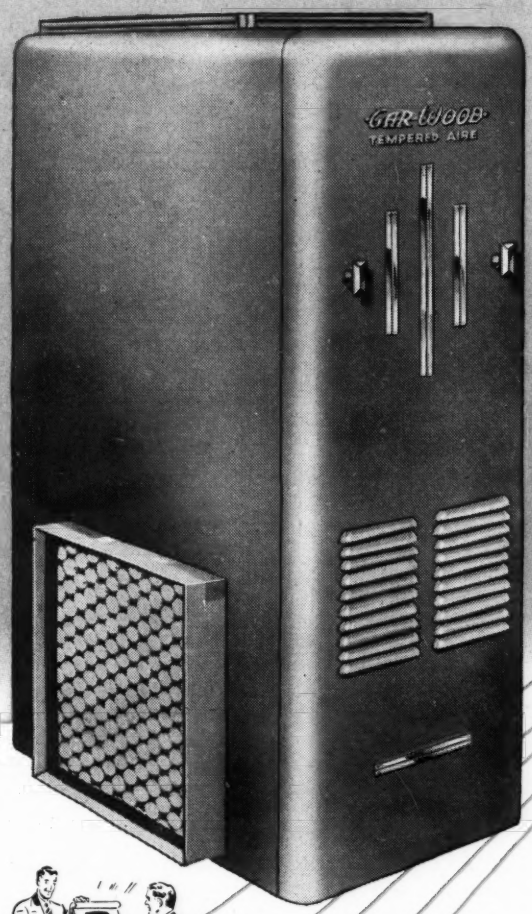
1 Hendricks, T. A., Chapt. 1, Coal Reserves, in Report of Energy Resources Committee to National Resources Committee, entitled "Energy Resources and National Policy," Jan. 1939, pp. 281-286. U.S. Gov. Print. Off., Washington, D.C.

2 Proved U.S. Crude Oil Reserve Totals 20,826,813,000 Barrels. A.P.I. Quarterly, April 1946, pp. 24-26.

3 The World's Oil, "Proved Reserves Still in the Earth Total More Than 59 Billion Barrels." The Lamp, Standard Oil Company of New Jersey, April 1946, p. 12.

4 Pew, James E., "Natural Gas and Its Products During the War." Petroleum in War and Peace, 1945, p. 124.

5 Winchester, D. E., "The Oil Possibilities of the Oil Shales of the United States": Federal Oil Conservation Board, Rept. II, Jan. 1928, pp. 13-14.



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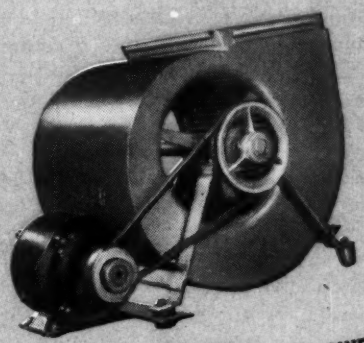

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TABLE 1.—ESTIMATED MINERAL-FUEL RESERVES OF THE UNITED STATES

Description	Reserve Jan. 1, 1946	Assumed annual production	Equivalent billions of net tons, bituminous coal, 13,000 Btu/lb. calorific value[a] Reserve Jan. 1, 1946	Percent of total fuel reserves	Assumed annual production	Reserve divided by annual production plus loss[b]
1	2	3	4	5	6	7
Anthracite—billions of net tons	15	0.060	15	0.6	0.059	165
Low-volatile bituminous coal—billions of net tons[c]	52	.115	56	2.2	.124	317
High-volatile bituminous coal—billions of net tons[c]	1351	.467	1403	54.2	.485	2024
Subbituminous coal—billions of net tons	818	.014	598	23.1	.010	.....
Lignite—billions of net tons	939	.001	484	18.7	.002	.....
Total, all ranks of coal, billions of net tons	3175	.660	2556	98.8	.680	2595
Petroleum, billions of barrels[d]	20.8	1.7	4.8	.2	.392	12.3
Oil from oil shale	92	1.7	21.2	.8	.392	54.1
Natural gas, trillions of cu. ft.[d]	135	4.0	5.2	.2	.154	34
Total, all fuels			**2587**		**1.226**	**1700**

a Heating values used in conversion: Anthracite, 12,700 Btu per lb.; low-volatile bituminous coal, 14,000 Btu per lb.; high-volatile bituminous coal, 13,500 Btu per lb.; subbituminous coal, 9500 Btu per lb.; lignite, 6700 Btu per lb.; crude petroleum, 6,000,000 Btu per bbl.; natural gas, 1000 Btu per cu. ft.
b 65% recovery is assumed for anthracite and 70% for all other coal and lignite.
c Includes some medium-volatile coal.
d Proved reserves only.

Two-thirds is found in the Great Plains and Rocky Mountain Provinces. However, there is a great difference in rank between the eastern and western coals. Practically all of the Eastern and Interior Province coals, except the anthracitic coals, are coking bituminous coals; and the Appalachian region coals are strongly coking. This region supplies most of the coking coals used in the United States. On the other hand, 80% of the Great Plains and Rocky Mountain Province coals are subbituminous coals and lignite. These coals do not coke on heating. As mined, lignite usually contains 28% to 45% and subbituminous coal 15% to 28% moisture. On exposure to air, the moisture is given off and the coal "slacks" into small pieces. It is not stable and cannot be stored for any length of time except under water, in carefully covered piles or in closed bins where rapid loss of moisture cannot take place. Lignite and subbituminous coals are used to a considerable extent for industrial and domestic fuel in the Dakotas, Montana, Wyoming, Colorado, and western Nebraska. However, the total market is small because of the low density of population in these areas, and these low-rank fuels cannot be shipped very far on account of their low heating value and their tendency to degrade in size with accompanying possibilities of spontaneous ignition.

Western States

Most of the bituminous coal in the western states is free-burning and noncoking. Relatively small deposits of coals suitable for the production of metallurgical coke occur in the Trinidad-Raton field of southern Colorado and northern New Mexico, the Sunnyside beds in the Castlegate field of Utah, and in Pierce and Kittitas counties, Washington. Some of the coals are slightly coking but do not become plastic enough to form coke that is strong enough for use in the iron blast furnace. In general, it may be said that anthracite and coking coals of metallurgical grade occur in the Eastern Province, coking coals of lower grade and lower bituminous rank in the Interior Province, and noncoking coals of lignitic, subbituminous, and bituminous rank in the Great Plains and Rocky Mountain Provinces.

It is evident from this review of the fuel reserves of the United States that ample supplies of coal are available for the production of the necessary requirements of gaseous and liquid fuels when the natural gas and petroleum reserves approach exhaustion and need to be supplemented from other sources. Satisfactory fuel gases have been manufactured from coal or from coke and petroleum for many years. Processes and equipment for this purpose have been well-developed and the costs are known. In recent years in Germany, in particular, processes have been developed and put into commercial operation for the manufacture of liquid fuel from coal and from lignite. It is quite reasonable, therefore, to assume that plenty of gaseous and liquid fuels will be available in the future for many years, probably a thousand years; and of course, for a much longer period if atomic energy can be harnessed economically for the generation of heat and power. The cost probably will be greater than the present cost of petroleum and natural gas, but future developments in the more efficient utilization of fuels should go far in offsetting the cost of conversion.

Processes for Producing Fuel Gases from Coal

Twenty years ago, when it seemed that the peak production of natural gas had been reached in the Appalachian region, the Bureau of Mines undertook to investigate the produc-

tion and substitution of manufactured gas for natural gas. The results of this study, published in Bureau of Mines Bulletin 301 in 1929, are applicable when conditions arise which require the utilization of coal for supplementing declining supplies of natural gas.[6] In this publication the situation with respect to substitute gaseous fuels is summarized in the following words: "Much of our solid fuel resources, adaptable for use in the various gas-making processes, lie within the area confining a large part of our population as well as the large industrial centers. With this knowledge, recognizing that the supply of petroleum recoverable by present methods becomes exhausted substantially at the same time that the natural gas in any particular field is exhausted, one may be justified in concluding that the ultimate basic gas-making fuel from which a gas substitute for natural gas will be made in the future is coal. There are large supplies of coal suitable for making gas near our chief centers of population and industry or available to them."

Three types of combustible gases may be made from coal by existing commercial processes: coal gas, water gas, and producer gas.

TABLE 2.—Regional Distribution

Provinces	Billions of net tons				
	Anthracitic coal	*Bituminous coal*	*Subbituminous coal*	*Lignite*	*Totals*
Eastern	15.1	525.2	.....	.....	540.3
Interior	.2	508.0	.....	0.1	508.3
Northern Great Plains, Rocky Mountains, and Texas	.1	360.3	763.9	939.4	2063.7
Totals	**15.4**	**1393.5**	**763.9**	**939.5**	**3112.3**

Coal Gas

Coal gas is obtained by the destructive distillation or carbonization of coal in the absence of air in gas retorts or coke ovens. Approximately 12,000 cu. ft. of 550-Btu gas, 1400 lbs. of coke, 6 lbs. of ammonia, 3 gals. of light oil, and 11 gals. of tar are obtained from 1 net ton of good coking coal. The gas made represents about 20% of the total calorific value of the coal carbonized.

Water gas is produced by passing steam through a bed of incandescent coke, anthracite, or even certain bituminous coals, whereby a chemical reaction takes place between the carbon of the fuel bed and the steam, forming a mixture of about equal parts by volume of carbon monoxide and hydrogen. The straight water gas, usually termed "blue water gas," has a heating value of about 290 Btu per cu. ft. About 50,000 cu. ft. of gas is obtained from 1 ton of coke. When a good grade of bituminous coal is used, the calorific value of the gas is about 335 Btu, and the yield per net ton of coal is approximately 42,000 cu. ft.

However, the heating value of this blue gas is too low for practical use in the public utility gas industry, where the usual requirement is a calorific value similar to that of coal gas, that is, about 540 Btu per cu. ft. Therefore, the water gas is enriched by gasifying oil, which is sprayed on highly heated brick checkerwork in a carbureting chamber through which the water gas passes from the generator. This type of gas is called carbureted water gas.

Make Up of Plant

Manufactured gas plants may consist solely of carbureted water-gas machines or a combination of such machines operated in conjunction with coal-carbonization equipment, consisting of retorts or coke ovens. In such combination plants all or part of the coke made is gasified in the water-gas machines. Thus, the plant as a whole is a complete coal-gasification plant, and the gas sent out is a blend of coal gas and carbureted water gas.

Lignite and subbituminous coals can be gasified in properly designed gas producers, although such use has been negligible in this country. These fuels are not satisfactory for gasification in intermittent water-gas machines on account of their tendency to break down into small, light pieces which are easily carried out of the generator during the blasting period. In Germany brown coal, also a low-rank, high-moisture fuel, has been completely gasified in a continuous stream of oxygen and steam. This is a continuous water-gas process, which appears to operate satisfactorily with highly reactive fuels, such as brown coal, lignite, and subbituminous coal. When the gasification is conducted under a pressure of about 300 psi, as in the Lurgi process, a gas of about 500 Btu is obtained. This process has been used to supply city gas in Zwickau and Leipzig, Germany, and it might be used for making similar gas from subbituminous coal or lignite in the United States. The principal handicap in the use of oxygen for the production of fuel gases from solid fuels is the relatively high cost of oxygen. Considerable research is in progress on the development of cheaper processes for the production of oxygen. There is a possibility that ultimately this cost will be reduced so that these new processes may have commercial application.

Raw Materials Plentiful

In general, it appears that for the central and eastern part of the country, where the coal reserves are principally of bituminous rank, existing coal-carbonization and water-gas processes will be used. Because of its low heating value and high specific gravity, producer gas, while quite practical for industrial operations, could be used only for dilution, to a minor extent, of natural gas, which has a heating value of about 1000 Btu. In the northern and western Great Plains states, where subbituminous coal and lignite occur, these fuels may in the future be completely gasified by continuous processes yet to be perfected. It is possible to raise the calorific value of these water-gas-type gases to 500 or 550 Btu by chemical catalytic methods or the use of oxygen under pressure, but the economics of such processes are yet to be worked out. There is no dearth of raw material for the manufacture of unlimited quantities of such fuel gases.

Byproducts of Carbonization

Light oil and tar are obtained as byproducts in the manufacture of coal gas and coke. These byproducts can be used as liquid fuels. The heating value of coal tar averages about 16,500 Btu as compared to 19,000 Btu per lb. for petroleum. Much of this tar is used as a liquid fuel at steel plants. From 10 to 12 gals. of tar and 3 gals. of light oil suitable for motor fuel are obtained in the high-temperature carbonization of a ton of coal. Low-temperature carbonization of coal yields 20 to 35 gals. of tar per ton of coal. Low-temperature tar is more like petroleum than is high-temperature tar. It contains hydrocarbons similar to those found in petroleum.

Neither high- nor low-temperature carbonization converts all of the coal to liquid fuel. The liquid fuel is a byproduct, and it is not commercially feasible to maintain a liquid-fuel in-

6 Odell, William W., "Facts Relating to the Production and Substitution of Manufactured Gas for Natural Gas." Bureau of Mines Bul. 301, 1929, 179 pp.

This is the GORDON Spreader-Flame Line

which caused a sensation at the October show

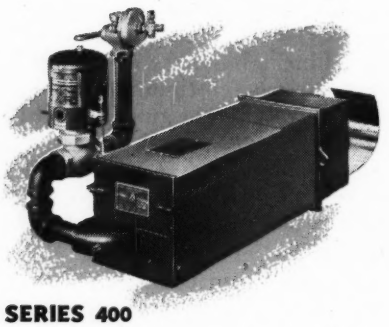
For Home Heating . . .

SERIES 84

Used to convert any round coal-burning furnace or boiler with grate diameter from 13″ to 36″ or any rectangular boiler with grate dimensions from 13″ to 45″. Three models, with capacities from 210,000 to 500,000 B.T.U. per hour.

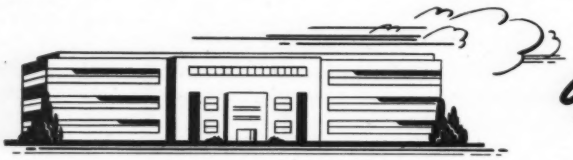
SERIES 302-20

Incorporates all of the outstanding Gordon features but also answers the need for a popular-priced line. Amazingly flexible in capacity—used from the smallest to the largest size of furnace or boiler, up to a capacity of 290,000 B.T.U. input.

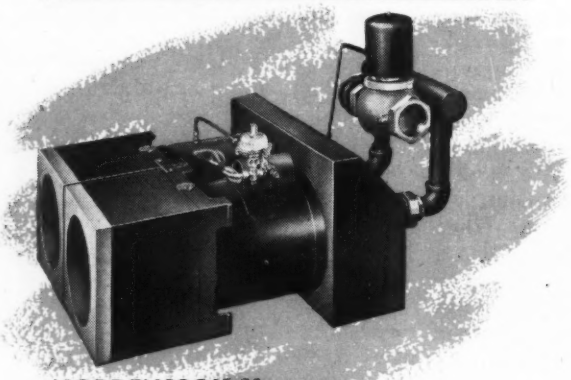


SERIES 400

For installations requiring or preferring the gun-type of burner. Can be used in any size or type of updraft boiler or furnace within its rating, whether round, square or rectangular. Capacities: 50,000 to 900,000 B.T.U.



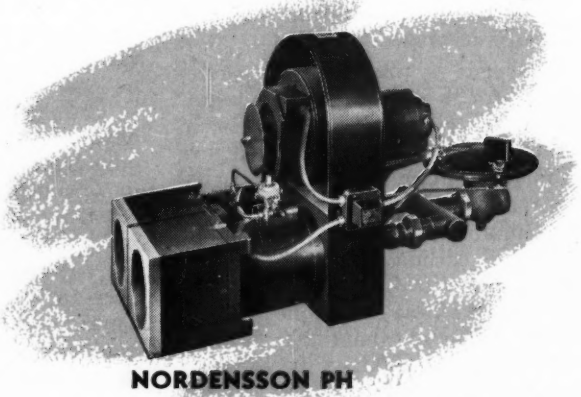
For Commercial Heating



NORDENSSON H

For apartments, factory and office buildings, schools, hospitals, theaters, etc. Atmospheric, luminous flame type; operates on gas pressures as low as 2″ W. G. using natural draft and with a minimum of noise. Easy to install.

GAS



NORDENSSON PH

A forced-draft companion to the Nordensson H type. Recommended for boilers and furnaces with down draft, insufficient draft or very limited combustion space or where gas consumption must compete successfully with the cost of other fuels.

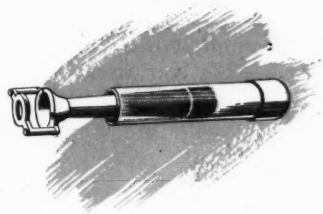
ROBERTS-GORDON APPLIANCE CORP., 137 ARTHUR ST., BUFFALO 7, N. Y.

These are the GORDON Features . . .

which make the line outstanding in the industry

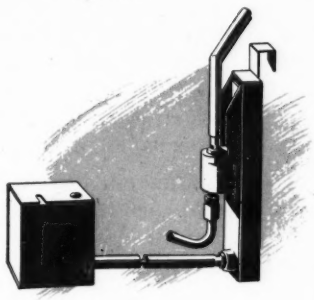
THE SPREADER FLAME

featuring a secondary air seal, produces a mushroom flame which scrubs the entire furnace or boiler wall, insuring higher operating efficiencies.



THE TELESCOPING MIXER

allows the burner to be positioned accurately in furnaces or boilers having a wide variation in ashpit dimension. Contributes to inventory reduction.



THE AUTOMATIC PILOT

uses a simple, highly dependable principle of thermal expansion whereby the main gas valve operates only when the pilot is properly burning. Easy to service.

THE IRIS ORIFICE

This single orifice is adjustable to gas inputs ranging from 50 to 600 cu. ft. per hour. On a standard fixed orifice this would require 75 different sizes!

BURNS ANY KIND OF GAS

The Gordon burner is adjustable to manufactured, natural, mixed or butane-air gas with no major change of parts and without sacrificing operating efficiency. We estimate the saving, in change-over work, to be at least $15 per customer.

Represented by:

Alabama, Birmingham 3
S. C. Bratton
405 Martin Bldg.

Illinois, Chicago 5
Ruud Humphrey Co.
1223 So. Wabash Ave.

Indiana, Indianapolis 4
Brooks Morris
5047 N. Capitol St.

Massachusetts, Boston 16
Herbert H. Skinner
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Michigan, Detroit 21
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12768 Grand River Ave.
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Missouri, St. Louis 8
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Appliances, Inc.
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J. G. Cameron
579 Insurance Bldg.

New York, Metropolitan
John C. Fullerton
292 Madison Ave.
New York 16

New York, Buffalo 13
W. A. Hammond
261 Highland Ave.

New York, Rochester 7
Wm. J. Gillette
196 Chestnut St.

Ohio, Cincinnati 2
F. J. Scull
626 Broadway

Ohio, Westlake
R. E. Landers
3606 Dover Center Rd.

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1500 N. 8th St.

Pennsylvania, Pittsburgh 19
Ridge Appliance Co.
1505 Berger Bldg.

Texas, Dallas 5
E. H. Durning Company
1067 Santa Fe Bldg.,
2nd Unit

Utah, Salt Lake City
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dustry based on a byproduct. In a coke-oven plant the main product is coke; therefore, the number of such plants cannot exceed the market available for coke unless the coke can be used in a parallel plant for the production of carbon monoxide and hydrogen for conversion to liquid fuels. Fortunately, such a process is now available. It has been used in the production of synthetic ammonia from gas or coke. In a similar manner, gasification and coking plants can be linked with a synthetic fuel industry by using the resulting gas and coke as well as the tar and light-oil byproducts in the manufacture of synthetic liquid fuels. The Germans thus combined in various ways their existing gas-manufacture and coking plants with both the coal-hydrogenation and the gas-sythesis process for the production of liquid fuels.

Conclusion

In conclusion, the presently proved fuel reserves of the United States, solid, liquid, and gaseous, may be summarized as amounting to the energy equivalent of 2.6 trillion tons of bituminous coal having a heating value of 13,000 Btu per lb. Coal and lignite comprise 98.8% of this energy reserve; 55% of this solid-fuel reserve consists of high-volatile bituminous coal, 23% subbituminous coal, 19% lignite, 2.5% low-volatile bituminous coal, and 0.5% anthracite. The highest-rank and the highest-grade coals, amounting to about one-sixth of our total tonnage of coal and lignite, occur in the eastern and Appalachian states, where industry and population are more concentrated. Another occurs in the central states on both sides of the Mississippi River. This coal is of lower rank and much of it of lower grade, but it is all of high-volatile bituminous rank, although less strongly coking than the eastern coals. Eighty per cent of the remaining two-thirds of our solid-fuel reserves consists of subbituminous coal and lignite in the Dakotas, Montana, Wyoming, Colorado, and Texas. All of these fuels can be converted by suitable processes to gaseous and liquid fuels. Some are operating commercial processes that have been used for many years in the gas- and coke-manufacturing industries. These are applicable to the coking coals of the eastern and central states.

No processes are operating commercially in this country for the production of fuel gases from the low-rank, noncoking coals that predominate in the western states. However, such processes have been developed and were in commercial operation before and during the war in Germany. It is probable that these methods can be modified for the gasification of American lignite and subbituminous coal, and it is possible also that new methods may result from American research now in progress in several organizations.

The Bureau of Mines has developed an annular metal-alloy retort which is now in pilot-plant operation at Grand Forks, N. Dak. A gas of high hydrogen content having a total heat of combustion of about 310 Btu per cu. ft. is obtained. Other investigators are working on the gasification of these low-rank fuels in fluidized or powdered form. It is reasonable to assume that in a few years more efficient and more practical methods will be developed than those now available for these noncoking fuels. With such developments, practically all parts of the United States will have available within reasonable proximity large reserves of solid fuels that can be used to supplement declining reserves of natural gas and petroleum for many years, certainly not less than 1000 years and probably for 2000 years.

Peoples Gas Light and Coke Co. Denies It Discouraged Range Sales

"WHOLLY unfounded and inaccurate" rumors that Peoples Gas Light and Coke Co., Chicago, is discouraging sales of new gas ranges were vociferously denied last month by B. H. Wittmann, domestic sales manager for the company, in an open letter addressed to all appliance jobbers, dealers, builders, architects, and men in allied trades.

Apparently the rumors contradicting the "well-known" sales and promotional policies of Peoples Gas stemmed from the company's recent announcement about limitation of new gas space heating installations, said Wittmann.

In re-emphasizing "in no uncertain terms our position regarding not only ranges, but refrigerators and automatic water heaters as well," Wittmann offered the following statement of "well-know policies":

1. Peoples Gas will continue to encourage aggressively the flow of the largest possible number of gas range sales through normal trade channels until annual postwar sales reach or exceed the 131,000 modern gas ranges sold in Chicago in 1941. The range market is practically entirely a replacement market.
2. Peoples Gas will continue to encourage aggressively the sale of Servel gas refrigerators, as fast as manufacturer's production permits, until that appliance is again—as it was in 1941—the largest selling nationally advertised make in Chicago.
3. Peoples Gas will continue giving strong support to retailers of automatic gas water heaters with the objective of increasing the sales volume of these appliances even beyond the dominant position they now hold in the Chicago market.

Brooklyn Curtails

An unprecedented demand for gas space heating following the end of the war and resulting in an increased gas load of huge proportions during the winter period has forced the Brooklyn Union Gas Co., Brooklyn, N. Y., to announce publicly that no more orders for gas heating equipment will be acepted until April 1, 1947. Present heating customers are not affected by the order.

"This emergency action," said President Clifford E. Paige, "is the direct result of an overwhelming demand for gas heating. This demand is now so great that if we were to try to meet it the resulting load would far exceed our present capacity to produce gas."

The company suggested in advertisements and newspaper releases appearing recently that consumers in the area it serves defer the purchase of gas heating equipment until next winter.

"A Word of Caution"

A public warning to investigate first whether or not gas service is or will be available before purchasing either gas consuming equipment or new homes with gas-fired appliances was voiced late in August by the Atlanta Gas Light Co. of Atlanta, Ga. The notice appeared in a four-column advertisement in The Atlanta Journal.

"The critical material and equipment shortage is seriously curtailing additional gas service," said the ad. So . . .

"We urge you, in order that you may not be inconvenienced by the lack of gas service, either to consult the gas company yourself or to insist that the company where you are purchasing gas equipment contact the gas company before you replace any other type of equipment, or before you purchase gas equipment which requires a new service.

MEET the **captan** molecule—of course, no one has ever actually seen it, but everyone who comes in contact with it recognizes it. Just one of these tiny molecules mixed with as many as 50,000,000 molecules of gas and air will broadcast its own presence—and the presence of gas! This infinitesimally small ratio proves the inherent economy and positive odorization provided by **captan**—*the* natural gas odorant.

captan *Advantages*

1. GAS-LIKE SMELL
2. AVAILABLE
3. VOLATILE
4. HARMLESS
5. ECONOMICAL
6. EASY TO HANDLE
7. UNIFORM
8. DOESN'T FADE OUT

NATURAL GAS ODORIZING COMPANY, INC.

Chemical Specialties for the Gas Industry

PLANT AND GENERAL OFFICES: 7620 Wallisville Road, Houston 10, Texas
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CAPTAN
THE NATURAL GAS ODORANT

LP CAPTAN
THE ODORANT FOR LP GAS

This booklet identifies ranges equipped with the **HARPER CENTER SIMMER BURNER**

A STOCK QUESTION being asked by more and more women when they set out to buy a new gas range is, "Has it got the Harper Center Simmer Burner?" That's the cue for your salesmen here, which is put in every Harper man to produce the booklet shown equipped range when it leaves the factory.

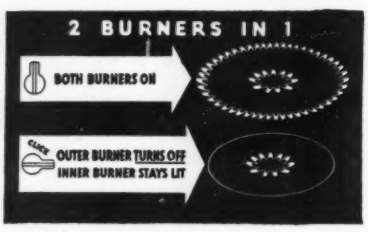
Our consumer advertising is telling prospective range buyers to look for this identifying booklet. It also points out that the famous Harper "2 burners in 1" Center Simmer Burner saves up to 39% on gas, keeps kitchens up to 9 degrees cooler, saves hours of kitchen pot-watching weekly, and has many other advantages possessed by no other top-burner.

To trade-up your customers to a higher priced range, *demonstrate* these advantages. We offer you a special FREE booklet, "How to Sell More Gas Ranges," which contains a series of quick, convincing floor demonstrations planned to dramatize the advantages of the modern gas range. Send for copies for your salesmen. Harper-Wyman Company, 8562 Vincennes Avenue, Chicago 20, Ill.

FIVE MAGAZINES THAT INFLUENCE GAS RANGE BUYERS

Ladies' Home Journal *American Home*
Better Homes & Gardens
McCall's *Woman's Home Companion*

These leading national magazines have a combined monthly readership of more than 21,500,000 women—families in the upper income brackets—housewives who want and can *afford* to buy deluxe gas ranges. Take advantage of the Harper Center Simmer Burner advertising in these magazines . . . *demonstrate* and *talk* the advantages of Harper top burners.



The Harper Center Simmer Burner operates on the unique principle of "2 burners in 1"...a STARTING BURNER *for frying and to* start *foods boiling, plus a small, economical* COOKING BURNER, *to maintain the cooking...both controlled by the same handle. It is subject to finer gradations of low heats—greater control and economy—than any other top burner made.*

HARPER CENTER SIMMER BURNER

"...Holds the Lines for Gas"

HARPER
CENTER SIMMER

TECHNICAL TRENDS

By GUY CORFIELD, Technical Editor

Kitchen Ventilation at the Range

Considerable interest is being shown by the gas industry in kitchen ventilation, aimed primarily at removal of the heat, water vapor, and cooking odors and vaporized greases that are the unavoidable accompaniment of the cooking process regardless of the type of fuel used.

With the modern trend towards smaller, more compact and more tightly built dwellings, such ventilation is becoming increasingly desirable and the need for forced removal by fan or blower, rather than dependence on leakage, gravity flue or chimney effect, seems evident.

It appears logical to remove these cooking products at a point as close to the source as possible. A design, for instance, wherein the range is against an inside wall and the fan discharges outward through the outside wall above the sink, merely tends to draw the products past the housewife's head as she prepares food or washes dishes. A ceiling opening or high canopy above the range is somewhat more effective but actually can capture only a relatively small proportion of the products, and then only after this proportion has cooled considerably so that the condensed grease droplets have opportunity to deposit on the wall or ceiling before arriving at the opening.

Remove Near Source

To narrow down the uncontrolled path of the products to a minimum, the most direct and rapid removal can obviously be attained by applying the suction to the point where the products emerge from the oven and broiler, and to a hood or canopy or other structure overhanging the top section as completely and closely as is consistent with good appearance and reasonable working convenience.

There are many ways of approaching this objective (the variables consisting of the treatment of the oven and broiler products inasmuch as the top-section products can only be captured, with reasonable air movement, by a canopy), for example: the suction opening can be in the under side or upper back of an overhanging canopy which can be attached to the wall or otherwise made a part of a cupboard or cabinet assembly, so that the oven and broiler products will discharge from the range in a normal manner at the rear under this canopy; additional suction can be applied direct to the oven and broiler; the suction duct can be in the wall discharging upward with the blower in the attic, or downward with the blower in the basement. A convenient method for ground floor installation would be with the duct going downward through the floor back of or under the range, and along the basement ceiling to an outside point, with the blower in the basement; a practically self-contained unit could incorporate the canopy or hood, and the blower, as part of the range, with duct connection at the bottom or back of the range so that simple duct installation could lead to the most convenient disposal point.

Most of the year in most climates the withdrawal from the house through the kitchen, during cooking operations, of the necessary amount of air of the order of 150 to 300 cu. ft. per minute, would seem to be at least not undesirable. In the winter heating season in cold climates such withdrawal for extended periods could upset and increase the heat requirements of a building, but could still be advantageous for short periods to control unpleasant cooking odors or heavy omission of cooking moisture.

Grease Deposits

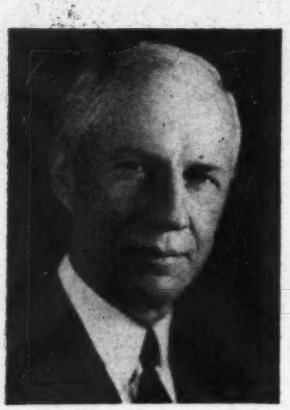
Question has been raised as to the amount of grease that may be deposited in the blower and duct system. While this may be sufficient to require infrequent periodic removal, with proper installation design this should not be difficult, and there would be compensation in the realization that such material had been removed from the kitchen. Again referring to the earlier statement that the emission of cooking products is common to all cooking processes regardless of the fuel used, and considering particularly the accompanying vaporized grease which tends to condense and deposit when cooled, it seems evident that *the warm flue gases coming from the burners of a gas range are an ideal vehicle* to carry away such grease and maintain it in vapor form until discharged outside the house. Therefore the gas range is particularly adaptable and applicable to kitchen ventilation, thereby placing the gas industry in a position to offer a ventilated kitchen with superior performance.

Considerable research has already been done on this subject by individual manufacturers and utilities, and by the American Gas Association Testing Laboratories, with results that are very encouraging. Domestic Gas Research Bulletin Number 40, "A Study of Various Methods of Kitchen Ventilation," recently published by the American Gas Association Testing Laboratories, carries an abstract as follows: *

> "Four types of kitchen ventilation systems studied show that it is possible to remove at least 50% of the heat produced by operations of a gas range, and under certain conditions as high as 70%. Moisture produced by cooking can be removed up to 98%. Air withdrawal rates necessary to remove indicated percentages of heat and moisture are not in excess of 400 cu. ft. per minute. Cooking odors can be confined to the kitchen in most instances or diluted to an acceptable degree in adjacent rooms with reasonable rates of air withdrawn."

* See GAS, Aug., 1946, p. 53, for more complete abstract of Bulletin No. 40.

CANDIDATES
For A.G.A. POSTS
YEAR 1946-47



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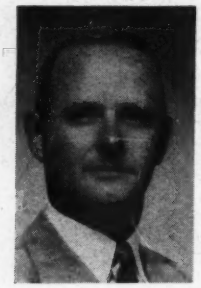

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J. M. BROWN
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INDUSTRIAL AND COMMERCIAL GAS SECTION: For Chairman—Karl Emmerling; for Vice Chairman—Leon Ourusoff.

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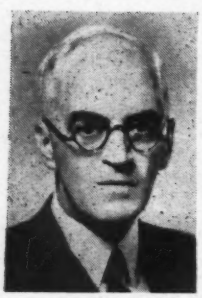

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ASSOCIATIONS

Convention-of-the-Year

FIVE DAYS packed with information and entertainment await an expected record throng of 10,000 this month, when the American Gas Association holds its 28th annual convention in Atlantic City, N. J., Oct. 7-11.

With an enthusiasm reawakened by the end of the war and the promise of greater progress in utilizing the Blue Flame in the future, the attendants will hear industry leaders speaking in general sessions on vital problems of the day; will watch technical men in sectional meetings explore the latest developments in producing and marketing methods; and will see the greatest—and in 10 years the first—exhibition of gas appliances and equipment ever assembled.

Special trains from points as far distant as Dallas and Oklahoma City have been reserved to assure transportation for delegates from the Southwest and Midwest sections of the country.

Krug to Speak

Top speakers from outside the industry will headline the general sessions on Tuesday and Thursday mornings. Foremost of these will be J. A. Krug, whose interest in the affairs of the gas industry since assuming the post of Secretary of the Interior has been demonstrated by his numerous appearances at conventions and hearings. Krug will discuss "The Government and Business" at the Tuesday morning meeting. Heading the Thursday session will be Elmo Roper, New York marketing consultant, who will tell "What the Public Thinks of Business."

Other speakers not affiliated directly with the gas industry will include Arthur H. Motley, Parade Publications, Inc., New York, who will talk on "Public Relations and Selling"; Prof. Erwin H. Schell, head of business and engineering administration, Massachusetts Institute of Technology, forecasting "Economics of Tomorrow's Business"; and Robert F. Gerholz, of the Gerholz-Healey Co., Flint, Mich., detailing "The American Home — Today and Tomorrow."

Gas Industry Speaker

Top gas men who will address the general sessions will include President Everett J. Boothby, vice president, Washington (D.C.) Gas Light Co.; H. Carl Wolf, managing director, A.G.A., reporting on "An Industry With a Program"; Treasurer Edward F. Barrett, president of the Long Island Lighting Co., and others.

Parallel meetings of the Natural and Manufactured gas departments will be held at 10 a.m. Monday. A symposium on the outlook for raw materials—including coal, oil, liquefied petroleum gas, and natural gas—will be presented by four leaders in the respective fields, at the Manufactured Gas Department meeting. E. V. Murphree, Standard Oil Development Co. vice president, will speak on research, and William W. Bodine, financial vice president, Penn Mutual Life Insurance Co. of Philadelphia, will discuss the financial outlook for manufactured gas.

Natural Gas Department

Talks on volume selling and natural gas regulation will share the floor with committee reports at the meeting of the Natural Gas Department, presided over by Presidential Nominee R. H. Hargrove.

Monday's meetings will be capped by a special forum on employee relations, presided over by Fred Rauch, chairman of the personnel committee, and will include such speakers as Dr. George W. Taylor, professor of industry, University of Pennsylvania; C. B. Boulet, director of personnel, Wisconsin Public Service Corp., Milwaukee; M. V. Cousins, personnel director, United Gas Pipe Line Co., Shreveport, La., W. H. Senyard, personnel director, Louisiana Power & Light Co., New Orleans, and F. W. Fisher, director of personnel and public relations, Rochester (N. Y.) Gas & Electric Corp.

Sectional meetings holding particular interest will include the Tuesday session of the Accounting Section, at which employee training and employee relations will be chief topics; the opening session of the Industrial and Commercial Gas Section the same day, which will feature four addresses on research and marketing; the meeting of the Technical Section, which will spotlight a three-ply symposium on the subject of "Meeting Peak Loads," as reported from the Canadian viewpoint, the Chicago viewpoint, and the Koppers Co. outlook.

Further sectional meetings will be held Wednesday and Thursday.

The ladies' program will include home service breakfast Wednesday at the Traymore, and Tuesday's round table meeting at the Claridge.

Entertainment

Entertainment plans call for Monday evening dancing, the President's Reception and Dance on Tuesday, a ladies bridge tea Wednesday afternoon, followed by concert and musical features.

California, Here I Come (?)

The A.G.A. MIGHT hold next year's convention at San Francisco. The Time and Place Committee, headed by N. T. Sellman, vice-president, Westchester Lighting Co., reportedly wants it held there, and will recommend it at the convention this month. The choice is subject to convention ratification.

If the convention approves, it will probably take place Sept. 29 to Oct. 3, 1947. Headquarters have not as yet been selected.

Record Display Space Reserved For GAMA's Atlantic City Show

OVER 56,000 sq. ft. of floor space—enough to cover a regulation football field—filled with dozens of types of gas appliances will be shown A.G.A. conventioneers who attend the Gas Appliance Manufacturers Association exhibit being held this month at Atlantic City in connection with A.G.A.'s annual meeting.

Well over 75% of the huge Grape Auditorium, which has been reserved for the occasion, has been allotted to manufacturers for their displays. At the latest count, 137 gas appliance makers had arranged showings, and the called-for floor space was well ahead of the 55,300 ft. used in the 1936 exhibit, the highest previous record.

Latest scientific developments, new products, demonstrations, dramatic use of color, light and motion will be features of the display. Exhibitors' sketches reveal plans for striking presentation of gas refrigerators, gas ranges, heaters, air conditioning units, and many other products built with increased use of materials created during the war.

Despite shortages of special mate-

rials and exhibit craftsmen, exhibit designs submitted for approval so far show great ingenuity and dramatic design, according to GAMA President Lyle C. Harvey. Numerous exhibitors are using, for displays, revolving platforms, dioramas, 16 mm. motion pictures, mechanical books with self-turning pages, and special colored lighting effects.

Rendezvous and Resting Place

A place to meet friends, send and receive messages, and to rest enroute is to be provided at the GAMA exhibit. It is the Commercial Cooking Appliance Center, Booths 422 to 424, and is sponsored jointly by the Cleveland Range Co., Duke Manufacturing Co., G. S. Blodgett, J. C. Pitman & Sons, and Savory Equipment, Inc.

An attendant will keep a register of hotels, telephone and room numbers where desired, and will clear messages. The center is in the combined display booths of the five companies.

Servel, Inc., will feature an extensive exhibit on the huge auditorium stage, as it has in past exhibitions.

Dresser Industries has scheduled one of the largest exhibits, tracing gas from the well to its use in home heating, including as one display, a miniature compressor plant in full operation.

Coroaire Heater Corp. will use three revolving turntables, circled by spotlights, to display its products.

Sizing, Promotion, Ventilation Jobs Underscored by Retiring PCGA Head

"The jobs we have to do"—developing kitchen ventilation, water heater sizing, and research, promotion, and advertising ("here we are still far behind competing industries"—keynoted the address by Retiring President H. W. Edmund, which opened the Pacific Coast Gas Association's 53rd annual convention, held Sept. 10-12 at the Fairmont Hotel, San Francisco.

On developing kitchen ventilation, Edmund said: "There are many tough problems in connection with (it) . . . mechanical problems, ordinance problems, selling problems. Nevertheless, kitchen ventilation offers a solution to the talking point used by our competitors that gas is hot and dirty, and, at the same time, affords a real improvement in the home kitchen. We must get behind kitchen ventilation and our manufacturers must be alive to the necessity of making needed improvements in gas ranges."

Water heater sizing: "National committees have been urging the upgrading in quality of water heaters and gas furnaces, and offer programs to this end. The Pacific Coast Gas Association agrees with the desirability of better appliances but has refused to agree to CP as the best solution on the ground that it offers no adequate assurance of proper installation. In water heating, we feel that our water heater sizing program, nationally promoted, can do more for water heaters than anything else proposed. We have not yet offered an equally effective substitute for CP for the upgrading of house heating installations. . . . The perfection of all-year air conditioning, of laundry drying, of incineration, and other domestic gas uses, are still other jobs."

Research, promotion, and advertising: "The coal industry research program far exceeds our, and the promotion of the electrical industry is greater in both volume and, I think, in effectiveness. Granted that we have less money—this makes it all the more necessary that we direct most of our shot at the more important objectives and make a little go a long way by trying so to prepare our national cooperative copy that individual companies everywhere can tie in with it. Our PCGA cooperative advertising committee has been astonished recently to find that it would be far more costly for it to reproduce national advertising in Pacific coast media than to write its own. . .

"These and all other difficulties can be satisfactorily solved. . . . Their solution offers great reward."

Edmund's opening remarks set the stage for a three-day program of speeches and discussions in which 747 utility men from five western states participated, and in which A.G.A. and GAMA representatives headed by A. G.A.'s presidential nominee, R. H. Hargrove, held the floor.

Utilization Discussed

Of particular interest to gas men in the California sector was the Wednesday address by Roy A. Wehe, assistant director, Public Utilities Department, California Railroad Commission, who discussed utilization problems. Wehe laid heavy emphasis on the need for an overhauling of the "surplus" sales program, which he cited as a threat to the ability of the industry to meet "adequately the responsibilities of the future." In spite of the soon-to-be-constructed Texas pipe line, careful appraisal of current loads must be made if these responsibilities are to be met—"both from the point of view of the

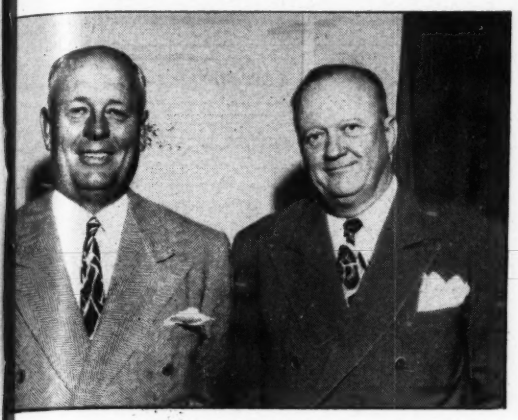
Awards for Accomplishment

FOUR PCGA awards plus $500 prize given by Servel, Inc., were presented at the Thursday night banquet at the Fairmont Hotel, which brought to a close the 53rd annual convention of the Pacific Coast Gas Association.

Highest awards went to the Committee on Water Heater Sizing for the "conception, production, and presentation" of its program, which won the Committee Award; to the Accounting Section, which won the Basford Trophy for making the most valuable contribution of the year among the various sections; and to John Nordin, Southern California Gas Co., who was given recognition by Servel for developing an adaptation of flue gas treatment to the water used in the evaporator cooler, which has "proved to be the most practical, economical, and efficient method for the control of scale, and, to some extent, the growth of algae."

Honorable mention was accorded Arthur F. Bridge, vice president, Southern Counties Gas Co., for his paper, "The Texas Pipe Line," and to K. L. Boosey, San Jose credit manager, Pacific Gas & Electric Co., for his address, "Better Relations With Personalized Collection Practices." The honor bestowed on Boosey was augmented with the recommendation that the next year's award committee review the plan's value to the industry "after further practical application, for possible recommendation for a higher award."

Committee and sectional chairmen of the award winners were Clyde Potter, Southern California Gas Co., and Claude Ballinger, Republic Heater Corp., co-chairman of the sizing committee; and J. W. Vanier, Southern California Gas Co., Accounting Section chairman. Awards were made by Awards Committee Chairman C. E. Pearman.



PRESIDENTS-ELECT. Of PCGA, LeRoy M. Edwards, left; of A.G.A., R. H. Hargrove.

THE SPOTLIGHT
On the
PCGA CONVENTION
In San Francisco

SPEAKER. A. F. Bridge, vice pres, Southenr Counties Gas Co.

VICE PRESIDENT-ELECT. A. H. Sutton.

PRESIDENT AND "FIRST LADY". H. W. Edmund, retiring PCGA president, and Mrs. Edmund, hostess at the convention held Sept. 10-12 in San Francisco.

PCGA AND GAMA. Clifford Johnstone, managing director, Pacific Coast Gas Association, at left; N. Henry Gellert, one of the new PCGA directors; and H. Leigh Whitelaw, managing director, GAMA.

WEST COAST GAS MEN. F. M. Banks, vice president, Southern California Gas Co.; R. N. Dreiman, general convention chairman; President H. W. Edmund, and F. S. Wade, president of Southern California Gas Co. and Southern Counties Gas Co. Los Angeles.

1946
Still the UNIVERSAL Selection of Cooking Perfection

See the latest automatic Universal Gas Ranges in the complete display of all models at GAMA's exhibit in the Atlantic City Auditorium during the AGA convention, October 7 to 11, inclusive.

For the latest in the nation's outstanding ranges, come to Booth 417-18-19, right in front of the center of the stage.

It will be an exhibition worth while seeing—and, of course, we will be happy to renew old acquaintances and to make new friends.

GAS
The Preferred Cooking Fuel

UNIVERSAL
The Preferred Gas Range

CRIBBEN & SEXTON
UNIVERSAL *Gas* RANGE
700 N. SACRAMENTO BLVD. CHICAGO 12, ILLINOIS

commodity to be supplied and the price at which it can be sold."

"In the true sense of the term 'surplus,' there is practically no such gas available at the present time. You will recall that industrial use of surplus gas, without standby, presented many difficult problems during the war. Such gas, too, has moved at very low rates; the average up to Sept. 5 was just under 14 cents per Mcf, contrasted with a rate of between 22 and 23 cents, if placed on the equivalent oil price basis." Rates should be changed and other controls inaugurated.

"It may be pertinent to observe and have in mind that if gas is sold in today's industrial market at rates less than what it will cost the gas industry to replace such gas for its customer requirements in the foreseeable future, giving consideration to the economic time factor, it is a serious question whether such a procedure is in the public interest and to the interest of the gas industry and its customers, especially if other desirable fuels can reasonably be utilized.

Supplies of All Fuels Important

"During the war period we learned it wasn't the adequacy of the gas supply alone that was important, but rather the sufficiency of the state's supply of all its fuels, and principally those of oil, gas, and electricity.

In a special election at the Pacific Coast Gas Association conference, Roy T. Richards, gas superintendent, Central Arizona Light and Power Co., Phoenix, was selected to serve out the unexpired term of M. A. Pooler, who retired after a year's directorship. Pooler was general manager, Tucson Gas Electric Light & Power Co., Tucson, Ariz.

"Many large industrial customers could change to oil burning with little inconvenience. If the price of the two fuels is placed on a comparable basis, then due to the inconvenience of curtailment of 'surplus' gas and to the necessity of maintaining and utilizing a standby fuel, many users would unquestionably discontinue gas usage. Thus a reduction in industrial gas sales would be brought about by choice of the consumer himself."

Wehe advanced the theory that some volumetric control would be the most feasible means of assuring reasonable distribution until such time as "our national economy becomes more stable." He pointed out, however, that "interruptible" sales have a "real place in the economic operation of a gas system."

Other papers of widespread interest to the convention were the "The Texas Pipe Line," by Arthur F. Bridge, vice president and general manager, Southern Counties Gas Co., Los Angeles; "The 400 Horsemen," by H. Leigh Whitelaw, GAMA's managing director; and R. H. Hargrove's paper on "The American Gas Association and its Work."

Sectional papers which received commendation included "Better Relations with Personalized Collection Practices," by K. L. Boosey, San Jose division credit manager, Pacific Gas and Electric Co.; a report on the gas water heater sizing program by Clyde H. Potter, Southern Counties Gas Co., Los Angeles; "Installation Standards for Plastic Pipe," by S. A. Bradfield and T. H. Gilbert, Southern Counties Gas Co., and others.

Special features were offered at several of the general sessions. In prefacing his talk "A Visit Over the Back Fence," in which he reiterated his pleas for new emphasis on "automatic," both in promotion and in gas range construction, Carl Sorby, CP Range Manufacturers Group chairman and vice president of Geo. D. Roper Corp., did some crystal ball gazing and "saw great things" in the gas industry's future. "Mrs. Wilson's Kitchen," with R. J. Canniff of Servel directing, followed Sorby on the program. Canniff and his assistants presented a demonstration of the New Freedom Gas Kitchen conceived by the company. Home Service Director Clara Ridder showed charts illustrating the research involved in designing a truly scentifically arranged kitchen, and then proved its worth by simulating the preparation of a meal with a minimum of waste motion.

"The Miracle Flame," a new gas industry sound motion picture in color, produced by the cooperative advertising committee under Chairman R. R. Gros, was premiered at the Wednesday afternoon general session. Intended for public relations showings and available to member companies, the movie gave in lay terms a history of gas formation, development, and usage.

The Thursday morning session was devoted to employee training and relations. "Teaching 'Know-How'" included presentations by R. F. Ogburn and R. C. Terradell, both of the Southern California Gas Co. Titled "What Went Wrong?" a playlet illustrating some of the basic principles of employee relations was directed by Judge Irvin Stalmaster, industrial relations consultant.

The ladies program included "Breakfast on Nob Hill," a morning broadcast at which convention ladies were special guests.

CALENDAR

October

American Gas Association Annual Convention and Exhibit—Atlantic City, N. J., Oct. 7-11.

34th National Safety Congress and Exposition—Stevens Hotel, Chicago, Oct. 7-11.

American Trade Association Executives Annual Meeting—Hotel Carter, Cleveland, Oct. 11-12.

National Electrical Manufacturers Association Annual Meeting—Hotel Traymore, Atlantic City, week of Oct. 27.

Midwest Gas Association and Iowa State College Gas School and Conference—Ames, Iowa, Oct. 28-30.

November

National Hotel Exposition—Grand Central Palace, New York City, Nov. 11-15.

National Metal Congress and Exposition—Atlantic City, Nov. 18-22.

Mid-Southeastern Gas Association—Raleigh, N.C., Nov. 21-22.

New Jersey Utilities Association—Seaview Country Club, Absecon, N.J., Nov. 22-23.

December

American Society of Mechanical Engineers—New York, Dec. 2-6.

National Exposition of Power and Mechanical Engineering, Grand Central Palace, N. Y., Dec. 2-6.

Light Hydrocarbons Offer Vast New Chemical Source

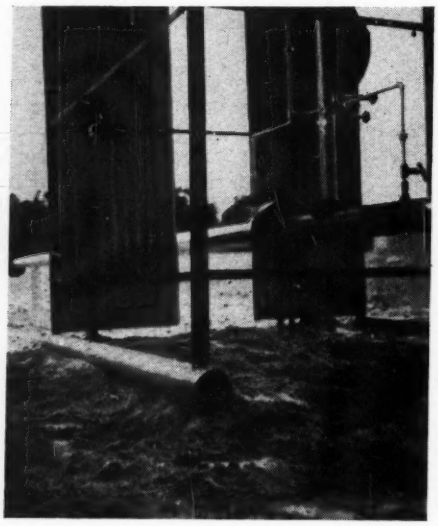
A vast source of new chemicals has been opened up by propane and other light hydrocarbon gases which were formerly wasted by the oil industry, Weller R. Pierce of the Phillips Petroleum Co., Bartlesville, Okla., reported recently to the Wichita, Kan., section of the American Chemical Society.

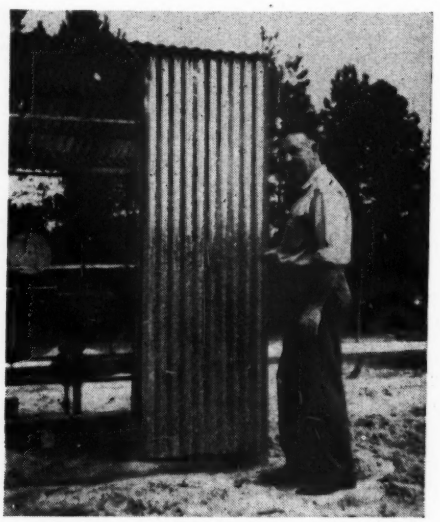
These gases are now utilized chiefly for fuel and for the manufacture of carbon black, Pierce pointed out, but great interest has developed recently in using the gases as building blocks in the production of chemicals.

Pierce predicted that a further large increase in the use of light gases is likely to result from the expected plastics boom. "The principal raw materials for many types of plastics and synthetic rubbers are ethylene and acetylene, two of the light gases," Pierce explained. A wide variety of chemical solvents and intermediates also is produed from gases of this group, he said.

OPERATING IDEAS

Junked Pipe Used for Meter House Anchor





SCHLEY C. OSBORNE, Shreveport district foreman, United Gas Pipe Line Co., Shreveport 92, La.

The small metal meter houses used in field and gathering operations are of light construction and unless properly anchored are "pushovers" for any high wind. Until recently, field and section foremen in the Shreveport area encountered considerable difficulty in mounting meter houses on sufficiently heavy foundations to hold the structures in place during windstorms, and to prevent settling of the building, which causes doors to become hard to open and close.

Schley C. Osborne's idea, illustrated in the accompanying pictures, practically eliminates this trouble. The metal framework of the meter house is welded to a piece of junked 4-in. pipe, approximately 8-ft. long, at the front and back sides of the house. This adds 86.3 lbs. to each side of the meter house, a total of 172.6 lbs. of deadweight ballast. The pipe is covered with earth to within 1 in. of the top, becoming in effect a "dead man" to hold the building in place. It is left open-ended so that sidewise shifting is offset by the tendency to dig in.

Mounting meter houses in this manner has been found to prevent settling to a great extent, and the bottom edges of the metal walls are elevated above the soil as a protection against rust and corrosion. The cost of pipe used, on a junk price basis, is about 60 cents for each building. This is much cheaper than concrete blocks can be made for the purpose, and the pipe makes a more satisfactory foundation.

Air Operated Meter Vise

SUGGESTED originally by E. H. Albasini of the gas meter shop, Public Service Co. of Colorado, Denver. Designed and constructed by employees in the company's gas customer's shop.

This new machine tool, a vise operated by air pressure, holds meters stationary on a work bench while repair work is in progress, thus saving time and bruised knuckles. A turn of the air valve opens or closes the jaws.

In the past, meters were held in place by two pieces of wood which were fastened to the bench top into which the meter was set. The loose fit of this arrangement made the work hazardous at times, since the meter would tend to shift about while being worked on. The possibility of injuries to the workman resulting from tools slipping due to movement of the meter or from the meter being toppled off the bench are entirely removed. He now has the full use of both hands to carry on his work.

Raynold Famini, repairman, is shown operating the new meter vise.

The WARD is *Easy to Install*

DEALERS APPRECIATE this added feature of the Ward Floor Furnace, particularly these days when there is a shortage of trained service personnel.

The Ward is simply and quickly installed, without muss or dirt. Being entirely self-contained, there are no wires to run—no assembling to do. The complete furnace is dropped into the floor opening, connected to vent and gas line, and it is ready to go to work in a day.

Once installed, you can count on virtually trouble-free operation for years to come—no structural failures, or adjustments that require extra service calls. For the Ward is built to highest precision standards. Every detail of Ward design and construction is right because there's more than a third of a century of floor furnace experience back of every Ward, plus the specialized skill that comes from building floor furnaces *exclusively*.

The demand for Wards far exceeds our production capacity and for the present, shipments have to be limited to our long-established dealers. However, we are looking forward to the day when we will be able to offer additional dealers the sales advantages of Ward Floor Furnaces.

WARD HEATER COMPANY

1800 West Washington Blvd., Los Angeles 7, Calif.

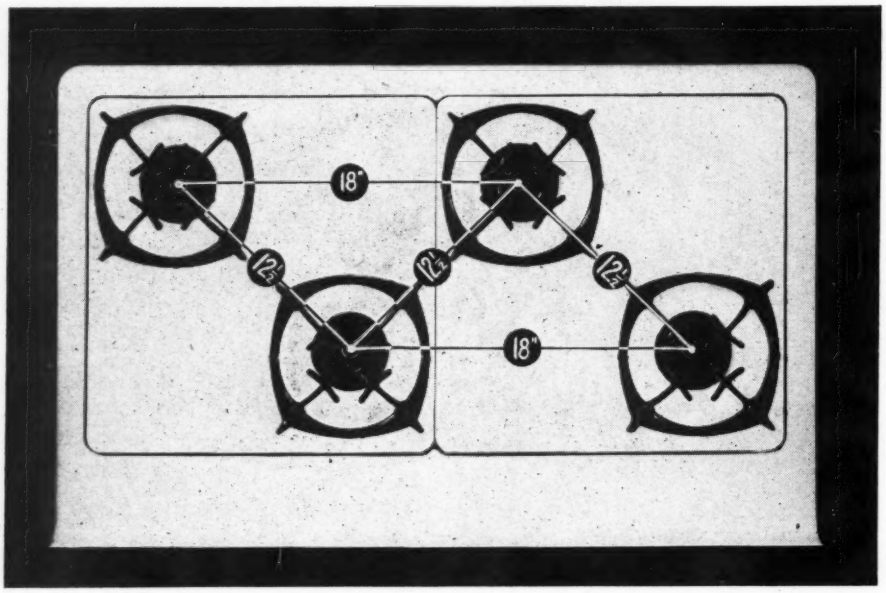
★

37 YEARS OF "KNOW-HOW"

WARD

FLOOR FURNACES

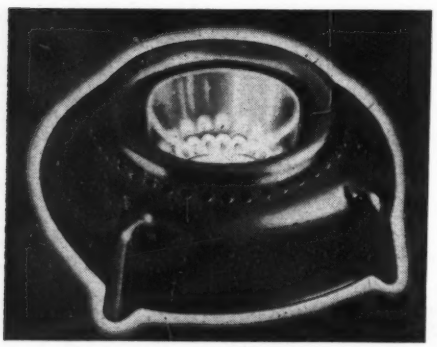
Sales Pointers ..... on New Appliances



ROPER STAGGERED-TOP RANGE

Manufacturer: George D. Roper Corp., Rockford, Ill.

Flexibility of operation and practicability are embodied in the "staggered cooking top," which is the salesman's best talking point in the marketing of Roper gas ranges. For use with large families, for use during the canning season, for those special meals when there are guests in the house—under any circumstance, Roper claims to have the most convenient and safest top arrangement on the market.



"Simmer-Speed" top burner.

Three other oustanding features are built into Roper ranges: the lifetime cooking charts, permanently fused into the oven and broiler drawer linings; the "Glo" broiler burner, available on the deluxe models, and the "simmer-speed" top burners.

1. *Staggered cooking top,* an exclusive Roper idea. This arrangement permits the use of four large cooking utensils simultaneously, which is impossible with conventional top-burner designs. Large families will welcome this feature, as will the housewife who uses an assortment of pressure cookers, large stew pots, and sterilizers during the canning season.

Ample working space is also provided, so that it is not necessary to lift one cooking vessel over another when placing it on the burner or removing it. This factor makes for safety as well as ease of operation; and in addition, the pan may be slid rather than lifted from the burner to the flush porcelain working space adjoining it.

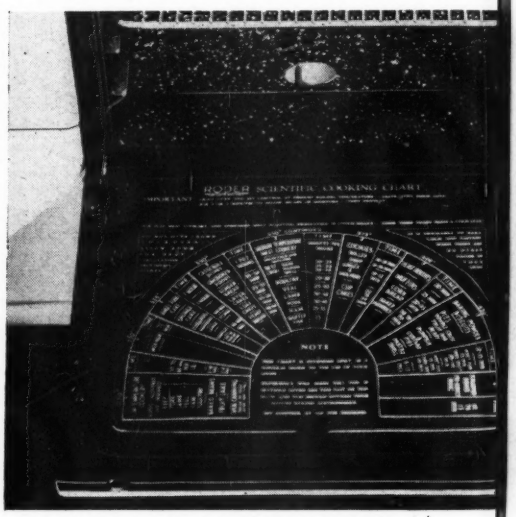
Safety, again, is assured by the fact that pot handles cannot be burned.

Cleaning is simple as all top parts are of porcelain.

2. *Lifetime cooking charts.* These charts are permanently fused into the linings, which are of porcelain and are therefore easily washable, making the charts always legible. The charts serve as auxiliary recipe books, giving guidance to better cooking in the broiler and the 3-in-1 oven. Both time and temperature for various cooking operations are listed.

3. *"Glo" broiler burner.* Installed in the deluxe units equipped with separate broilers, the "Glo" burner gives superior cooking performance. Infra-red rays penetrate the foods through an exclusive elliptical design.

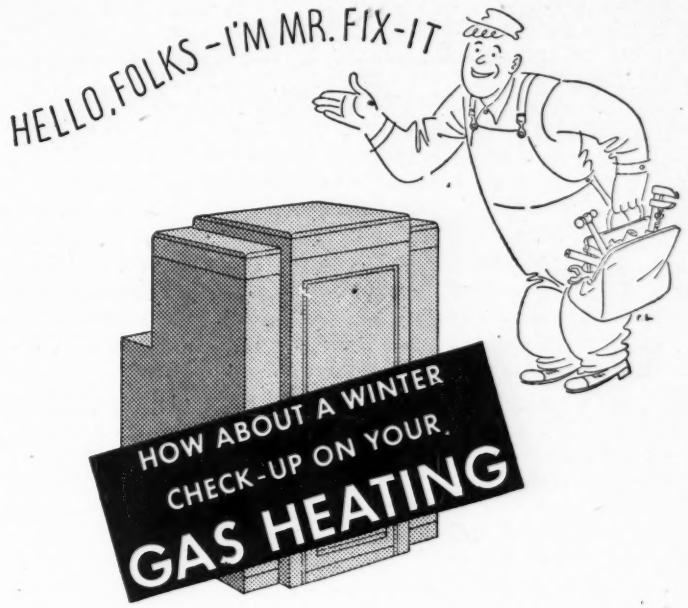
4. *"Simmer-Speed" top burners.* The cast iron "simmer - speed" top burners on Roper ranges are designed to fit every type and kind of cooking utensil. They are ideal for semi-waterless cooking, quantity water cooking, and, because of many variable adjustments, give perfect control for any cooking operation. The burner and utensil support are so designed that a small measuring cup can be used in connection with the "simmer - speed" burner, while a large cooking vessel can be used with the full operation of the burner. As all burner heads are porcelain enamel cast iron, they will not warp and are easy to keep clean.



Scientific cooking chart, fused into oven door lining.

Clock, scientific top arrangement make cooking easy.

HERE IS A TYPICAL P·G·and E· NEWSPAPER AD PROMOTING GAS



It pays to 'tend to things ahead of time, especially the "fix-up" adjustments and repairs of Gas Heating equipment. Cold wintry weather is not far off. Do what you can yourself or play safe and call a gas heating repair man before he gets snowed under with the coming winter season rush of work.

It will pay you to put new filters into your Forced-Air Furnace. More heat... faster... cleaner results from this low cost replacement.

You'll be amazed at how much dirt, dust and lint collects in your Floor Furnace pit or Cold-Air return of your Furnace. Clean out all of these places for more efficient heat and cleaner heat.

If your furnace does not seem to be acting "just right" have an overall check up made of thermostat, regulator, motor, fan and filters...It's good heat assurance to do this.

SEE YOUR LOCAL GAS HEATING DEALER

P·G·and E·

PACIFIC GAS AND ELECTRIC COMPANY

G210-1046

GAS INJECTION: Its Effe n

Gas injection holds advantages as well as disadvantages for the gas companies. Fuel prices and peak loads will reflect the impact of the injection program which is now being carried on in California's oil fields. The author believes these factors may be directed into profitable channels both because of and in spite of injection, if oil producers and gas companies work out a cooperative program. A discussion of the economics of this process directed at utility readers.

IT is the objective of the oil producer to recover the hydrocarbons contained in the underground reservoir as economically, efficiently and completely as possible. In certain cases and under certain circumstances it has been clearly shown that this objective can be accomplished most effectively by controlling the pressure in the reservoir through the means of gas injection.

In order to appreciate the part that gas plays in bringing oil to the surface it might be well to see what an oil reservoir is like. Here, for illustrative purpose, is what might be termed an ideal reservoir — the petroleum engineer's dream, so to speak.

The sand type reservoirs, characteristic of California, consist of porous and permeable rock overlaid by an impervious shale. The interstices, or pore spaces, contain gas, oil and water under pressure. Normally under reservoir pressure the oil contains gas in solution, and any gas in excess of that which can be held in solution under the existing pressure and temperature will accumulate as a gas-cap in the upper portion of the reservoir. The relative positions of the three fluids in the reservoir are the result of gravitational segregation, the oil above the water and the gas above the oil.

Natural Recovery Mechanisms

There are certain forces initially inherent in the reservoir which lead to the natural recovery of oil. One or all may be operative, depending on the conditions prevailing in the individual reservoir. These forces are: *gravity, dissolved gas, gas-cap, and edgewater.*

The force of *gravity*, of course, is always present in any oil reservoir. The part which gravity plays in recovering oil depends upon the physical characteristics of the individual reservoir and the extent to which the other inherent forces may be operative.

In the *dissolved gas* type reservoir the oil is expelled from the sand solely due to the expansion of the gas released from solution in the oil. As fluid is withdrawn, the gas comes out of solution to occupy the space of the fluids removed. Ultimately, this results in an increased flow of gas to the well and a decreased flow of oil, due to a rising gas saturation of the sands and an increasing viscosity of the oil as the gas leaves it.

Under *a gas-cap drive*, however, the gas expands downward as the oil is produced, and in so doing, occupies the pore space as the oil level in the reservoir falls. This displacement action has the effect of sustaining the pressure on the oil and retarding the evolution of the gas dissolved in it. Depending upon the sand, fluids, and other characteristics of the individual reservoir, the oil recovery for a gas-cap drive will, in the opinion of some experts, be from 50% to more than 100% greater than in the case of a dissolved gas drive.

Where an effective *water drive* is present in a reservoir the water, due either to expansion or to hydrostatic head from a nearby outcrop, or both, will advance upward as the oil and gas are withdrawn. This gradual displacing action tends to maintain pressure in the reservoir and to cleanse the sand of oil as it encroaches. Strictly from the aspect of efficiency a water drive is generally believed to give the greatest oil recovery of all mechanisms, providing it is uniformly effective throughout the entire reservoir and properly controlled.

Why Inject Gas if Water Drive Is So Efficient?

If a water drive is the most efficient, it might properly be asked: Why not rely solely on that mechanism to recover the oil from a reservoir instead of injecting gas? In answer to that, two factors must be considered: first, the uncertainty as to the effectiveness of a water drive in a particular reservoir; and, second, the time element involved.

When a given reservoir is first produced it is not known definitely to what extent a water drive may be effective. The water encroachment may not be adequate to maintain the reservoir pressure required, and due to the lack of uniform permeability in the sand the water may encroach unevenly, or finger, and thus trap off sand areas containing oil.

Assuming, however, a satisfactory water drive mechanism is present and can be properly controlled, a severe restriction of the oil recovery rates may be required in order to give the water time to displace the oil and gas produced. Considering the large investment a producer has made in an oilfield, the slow rate of return under a complete water drive process may be economically unattractive. Considering both the uncertainty and the time element of the water drive, the producer may quite properly conclude that a gas injection program is justified to supplement the natural water drive.

The Advantages of Gas Injection

As previously stated, the objective of the producer is to recover the maximum amount of hydrocarbons from a

Titled "Gas Injection in California Oil Fields—The Producers and The Gas Companies," this paper was originally presented at the April meeting of the Pacific Coast Gas Association. The author, a Stanford graduate, has been with Standard Oil of California for 14 years, the last six of which were spent in the gas division of the Producing Department; since March, 1945, he has served as manager of that division.

n Producer and Gas Company

By R. E. CLARKE,

Assistant Manager, Gas Div.,
Standard Oil Co. of Calif.,
San Francisco.

reservoir as efficiently and economically as possible. Gas injection has proved itself to be an extremely effective means toward accomplishing this end. Seven of the principal benefits from a gas injection project which lead to a greater ultimate recovery of hydrocarbons are shown in *Table 1.*

How is Gas Injected

From the foregoing it can be seen that the advantages of gas injection are both many and great. As a matter of interest it might be well to consider briefly how the gas is returned to the reservoir.

Except in situations where higher pressure gas from another zone in the field can be used directly for injection, as is partially being done now at Kettleman Hills, it is necessary to compress physically the gas after it has been processed for the recovery of its liquid content. The dry gas is compressed to the pressure necessary and injected through a well used for that purpose located at or near the crest of the structure.

At Kettleman Hills, the gas being injected comprises both dry gas from the gasoline plants and wet gas direct from the underlying Eocene zone. The dry gas, having been processed in the gasoline plants, is boosted from plant pressure for injection; the Eocene gas on the other hand, is merely run through a 2000 psi trap and then injected directly into the upper zones through a well for that purpose. The injection pressures range from 600 psi to 1800 psi.

Of particular interest is the cycling project at Paloma, which commenced operating nearly two years ago, because it is the largest and first project of its type undertaken in California. Paloma is a typical gas-condensate pool having an initial reservoir pres-

CHIEF BENEFITS OF GAS INJECTION

In Promoting Greater Hydrocarbon Recovery

1. *Maintains Viscosity of Oil.* The viscosity of the oil in a reservoir is directly affected by the amount of gas dissolved in it. When oil is saturated with gas, which is possible at high pressure, its viscosity is materially lower, giving the oil greater mobility in flowing through the sand to the well bore. For example, if the pressure in a reservoir containing 30° API gravity tank oil were permitted to drop from 3600 psi. to 1000 psi., the viscosity of that oil would more than double. Considering that the flow of the oil through the sand is inversely proportional to its absolute viscosity, a lower viscosity is extremely conducive to oil recovery. The maintenance of a gas-cap in the reservoir will tend to prevent the escape of gas initially dissolved in the oil.

2. *Maintains Surface Tension of Oil.* The reservoir engineers are of the opinion that by keeping the surface tension of the oil low the better will be the producing characteristics of the reservoir. Oil in which the dissolved gas is retained in solution, such as by gas injection, will have a lower surface tension than if the pressure is allowed to decline and the gas permitted to come out of solution.

3. *Serves as Expulsive Force.* As the oil approaches and enters the bore of the producing well, where the pressure is necessarily reduced, some gas coming out of solution will remain in the oil as occluded bubbles, which lightens the producing column and assists in lifting the oil to the surface.

4. *Prevents Oil Entering Gas Sands.* By sustaining a gas pressure above the oil, the oil is prevented from flowing up to the crest of the structure and into the parts originally containing gas. A movement of oil into the overlying gas sands results in a loss of oil in the sands which were initially free of oil.

5. *Controls Edgewater Encroachment.* By controlling pressure in the reservoir with gas, the encroachment of edgewater may be retarded and controlled. An uncontrolled water drive may sometimes result in an uneven or spotty advance of water, which may entrap portions of the undrained oil sand. The entrapped oil, if recoverable, may be obtained only with difficulty and at added cost.

6. *Lowers Production Costs.* In an ideal reservoir, practically all of the recoverable oil may be produced by natural flow without requiring the use of artificial lifting devices, such as sucker rod pumps, Kobe pumping units, and gas lift operations, all of which, by comparison with natural flow, are considerably more costly per barrel of oil recovered. The injection of gas is an effective way of sustaining this natural flow.

7. *Prevents Retrograde Condensation.* Under certain pressure and temperature conditions in a reservoir, a portion, and in some cases all, of the hydrocarbons may be in a gaseous phase. If the pressure in these reservoirs is permitted to decline certain of these hydrocarbons pass from the gaseous phase to the liquid phase, which physical phenomenon is known as retrograde condensation. From the producers' viewpoint this transition is most costly, inasmuch as in passing from a gas to a liquid form the hydrocarbons not only lose their high mobility, but as a liquid a certain portion becomes irrecoverable. It is, therefore, quite apparent that, if the maximum possible recovery of the hydrocarbons in a gas-condensate pool is to be attained, the pressure in the reservoir must be maintained.

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sure of over 4000 psi. After the gas produced therefrom has been processed, nearly all of which at pressures of 2000 psi, and the extractable hydrocarbons have been removed therefrom, the residual gas is compressed up to 4300 psi and returned to the reservoir. This sustains the reservoir pressure and prevents the loss of hydrocarbons through retrograde condensation. Except for relatively small volumes of gas used for fuel in the operations, all dry gas is being returned to the formation.

How Does Gas Injection Affect the Gas Companies?

At the outset it was stated that approximately 275 MMcf per day of gas is now being returned to the oil reservoir in California by injection projects now in operation. The exceedingly satisfactory results so far obtained should be instrumental in encouraging additional projects as well as justifying increased injection rates in some of those already in operation. It is conceivable that within the next several years the volume of gas being injected into oil reservoirs may be more than 50% above what it is today.

Immediate Effect

You in the gas companies have already felt the immediate effect of these gas injection programs, as evidenced by the considerable decrease in the oilfield gas available to you. This is not only apparent in the volumes available throughout the year, but also in the lack of flexibility which in the past was provided by certain of the oilfields in meeting your seasonal peaks. It is generally believed that steady and continuous rates of withdrawal and injection give the most beneficial results under a gas injection program. Lack of this flexibility in oilfield deliveries has been primarily responsible for the development of dry gas underground storage projects in the southern portion of the state, where gas from dry gas fields is not available to meet the fluctuating peaks during the winter period.

Ultimate Effect

While, from the short-term point of view, this decrease in oilfield gas has created immediate problems for the gas companies, from the long-term aspect the gas companies stand to benefit. When the gas now being injected has served its useful purpose as a reservoir agent, it will then become available to gas companies more or less on the same basis as gas from dry gas fields. That is to say, the gas can be made available in varying quantities as required by the gas companies to meet their fluctuating requirements.

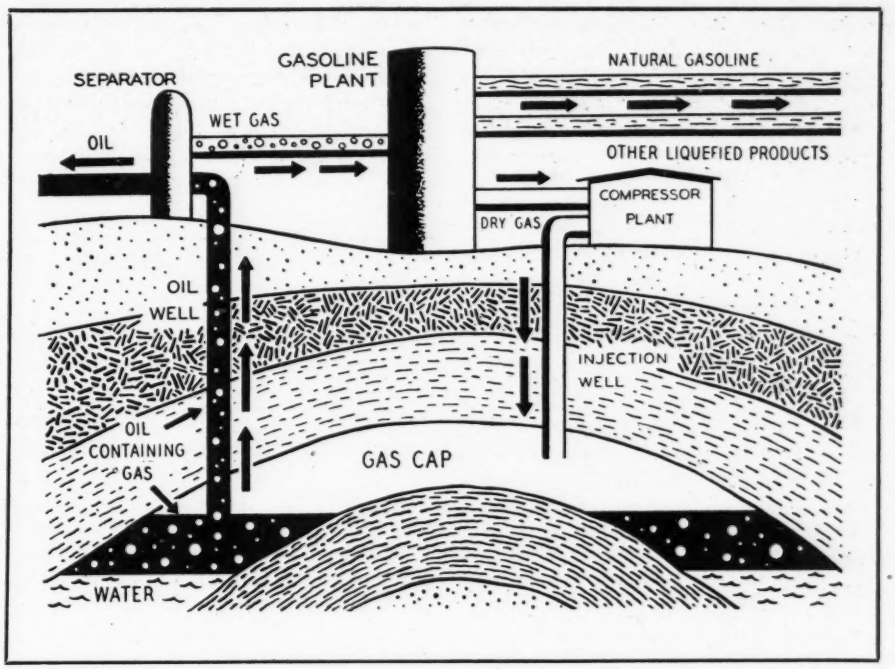

Diagram of one type of pressure maintenance operation. After being treated for removal of natural gasoline and other products, the gas is forced back into the ground to maintain pressure in the oil sands.

When Will Injection Gas Become Available?

Probably one question in the minds of you gas company people is: When will this gas now being injected become available? This is a rather difficult question to answer for, among other factors, it depends a great deal on the results being obtained in the individual injection project. Looking, however, at the over-all picture, and in light of present developments, it would seem that it would be at least 15 to 20 years before any appreciable volumes of gas will be made available for sale from fields where injection programs are being undertaken.

Effect of Gas Sales Price

One factor which will have a very definite bearing on the time when gas is sold from these injection projects is the prevailing sales price of the gas. As you can appreciate, the economic law of diminishing returns will, in time, be a determinate in any injection program. As the program continues, the quantity of recoverable hydrocarbons in the reservoir progressively becomes smaller as does their rate of recovery.

At the present time the benefits from injection programs are so great that the operating costs by comparison are relatively insignificant. As time goes on, however, operating costs of such projects will become a more important element, and ultimately will be the deciding factor leading to the discontinuance of the individual project. Gas used in the injection project is one item to be included as an operating cost. The sales price applicable to that gas very definitely establishes that cost: first, the fuel cost, and second, the investment cost attributable to deferring the sale.

Fuel Cost: Depending on the individual project, the plant and compressor fuel has been estimated to range from 7% to 14% of the gas injected. For the sake of argument, let us assume 10%. Therefore, if 10% of the gas will be consumed as fuel to inject it and to process it again when it is returned from the reservoir, the cost of injecting—say 50 MMcf per day—would be $400 per day if gas has a market value of 8 cents per Mcf, and $800 per day if the market value is twice that—or 16 cents. This fuel cost at some stage in the injection project undoubtedly could be the factor in concluding that further injection is no longer economically attractive.

Deferment Cost: In addition to the cost of the gas so consumed there is also a cost resulting from the deferred sale of that gas. For instance, assume that the sales revenue is invested today at a return of 4% compounded semi-annually. Gas sold today at 8 cents per Mcf would then earn 1¾ cents per Mcf in five years, and 3.9 cents per Mcf in 10 years. Loss of this interest factor must unquestionably be considered as a cost in carrying on the injection program. As the sales price

of gas varied, this cost would vary proportionally. If a sales price of 16 cents were used in lieu of 8 cents, the deferment cost would then be double, or 3.5 cents per Mcf for 5 years, and 7.8 cents per Mcf on a 10-year basis.

Applying the above figures to an injection program of 50 million cubic feet per day, the combined fuel and deferment cost for gas, merely on a 5-year basis, would be $465,000 per year greater with the sales price of gas at 16 cents per Mcf as compared to 8 cents per Mcf.

One very significant point is that the deferment figures cited above apply only so long as the future sales price of the gas is equal to the prevailing price. Depending upon the extent by which the future sales price will exceed the prevailing price, it is quite possible that the deferment factor may actually result in what might be termed a "deferment profit." For instance, using the example first cited of a prevailing price of 8 cents per Mcf, it was shown that the deferment cost for five years at 4% was 1¾ cents per Mcf. If, however, the gas is sold after five years at 9¾ cents per Mcf instead of 8 cents, the deferment cost is zero, and any price in excess of 9¾ cents would, in effect, yield a "deferment profit."

Realistically speaking, it does not take a great deal of foresight on the part of the producers to conclude that the present sales price of gas to California producers is considerably below its competitive level in comparison with alternate fuels. Until such time as the producers' sales price attains its competitive level, both the cost of gas consumed in injection projects and the deferment factor can be charged, either partially or totally, against the difference between the present worth of the higher future sales price and the prevailing price. As has already been shown, in those instances where this difference exceeds the cost element the producer is realizing a so-called "deferment profit." This profit might quite properly be considered along with the other benefits in justifying a gas injection program.

A Field for Cooperation

It has already been indicated that the gas companies will benefit ultimately from the gas now being returned to the oil reservoirs. In effect, that gas is being held in reserve to be made available in the future as needed by the gas companies in meeting the varying requirements of their essential customers, which requirements should increase materially as the astounding expansion and growth of California continue. The reservation of this gas for that purpose seems preferable to the conditions that prevailed in the past, whereby, as a gas conservation measure, it was necessary for the gas companies to dump large volumes of oilfield gas during certain periods of the year to users, for whom a satisfactory substitute fuel was readily available.

It would therefore seem that there is more of a common interest on the part of both the producers and the gas companies in California gas injection projects than has heretofore been in evidence.

From the *producers' viewpoint* it is quite possible that, as the gas injection programs progress, there may be cases where the gas available in the particular field may be insufficient to carry on the injection project to the extent desired. At the same time, the gas companies may have unused space in their transmission facilities through which the gas needed by the producer at a given point could be supplied, either as an exchange, transport, or possibly under a long-term storage arrangement.

From the *gas companies' standpoint* it would be extremely beneficial if some of the gas being used in injection projects could be made available now to assist them in meeting the peak requirements of their essential business. Although a steady and continuous rate of gas injection is the most beneficial, the producers, at least in certain instances, probably could be induced to deviate slightly from this practice. For instance, if the producer has determined that a certain cumulative volume of gas must be injected during the year for a particular project, it might be possible through the installation of additional compressors to meet this overall annual injection requirement and, at the same time, divert some of the injection gas to assist the gas companies in meeting their peaks. As an inducement to the producer for doing this, the gas companies during the period of low demand might return the gas so diverted plus an additional quantity to reimburse the producer for the additional compressor capacity provided and for the cost to him of altering his operating plan.

Any arrangement which might be made between the producer and the gas company would, of course, depend on the benefits each received from the other, commensurate with the cost to each of providing those benefits. In any event, here appears to be a field of common interest where, by closer cooperation between the producers and the gas companies in California, both may mutually benefit.

Corrosion Engineers Join Forces To Promote Cathodic Protection

THE Correlating Committee on Cathodic Protection, formed at a meeting in St. Louis, Mo., on Aug. 19-21 in an effort to improve procedures for handling problems arising from cathodic protection of pipe lines, communications cables, railroad signal systems, and other buried structures, plans to undertake a program of education and assistance to be accomplished through the preparation of general and technical bulletins.

Provisional titles for these bulletins, which will be published and distributed on an industry basis, are: General Information on Cathodic Protection, Notification Procedure, Cathodic Protection Practices, and Joint Cathodic Protection Installations. The bulletins will contain examples of present recognized good practice and should inform the uninitiated and expedite local solution of inter-line problems of interference prevention and cooperative protection.

The committee contemplates the geographical listing of all operators of buried structures, making it possible to assist any operator intending to install cathodic protection in his need to notify operators of crossed or adjacent structures that may be affected. Primarily, the program aims to stress the importance and necessity of cooperation between managements, as well as corrosion engineers.

Those represented at the organization meeting were: American Association of Railroads; American Gas Association; American Petroleum Institute; American Water Works Association; Bell Sysem; Western Union Telegraph Co.; and the National Association of Corrosion Engineers. The American Transit Association was represented by an observer. H. H. Anderson, vice president of Shell Pipe Line Corp., Houston, Texas, was elected chairman of the group.

The Correlating Committee proposes to work closely with the Metropolitan Electrolysis Committees, who have already completed effective work on cathodic protection problems.

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PROMOTIONAL NOTES and NOTIONS

By STANLEY JENKS

Point of View

The naïveté of some editors is incredible. For example, the editor of one of the clatter and clinker (solid fuel) publications recently wrote: "Some mighty strong *(sic)* arguments are being advanced to keep natural gas from being piped to the East Coast. This is your fight Mr. Coal Dealer."

If the "mighty strong" arguments our colleague has in mind are those piles of pages of testimony in the Big and Little Big Inch pipe line disposal Congressional hearings, then he is a master of understatement. The pro-coal arguments are considerably more than "mighty strong." Most of them stink to high heaven. That is, if the public's welfare is the primary consideration.

Help for Husbands

When a thoroughly undomesticated husband is left to fend for himself at home over a prolonged period, he needs help and guidance. I know, because she who makes the house a home has been gone for several weeks, and will not be back for several weeks more. Restaurant meals soon pall, and life on the intake side would be pretty miserable but for the genius who has made cooking remarkably easy for an unskilled skilleteer like myself. I mean the frozen food lad, who now sells complete meals all set up for the oven and frying pan—a real boon to the poor gink starving for a home-cooked meal. In my instance, this simplicity of frozen meals has undoubtedly turned me from an unprofitable minimum gas bill customer into a nearly normal user. The frozen food has been a load-builder. And why, as a corollary, hasn't somebody told me about bread, when properly wrapped, staying fresh in the refrigerator for two weeks, if necessary?

I think there is an untapped potential load from present facilities if properly exploited by our home service lassies. Somebody should prepare a special cook book for wifeless husbands. I'll gladly write the foreword. In fact, I'll contribute a couple of nifty recipes of my own. (Sodamint manufacturers, please note my cooperation.)

Water Heating

My scouts tell me that the electric water heater manufacturers are trying to offset their obvious disadvantage of slow recovery by building more and more double heating unit jobs. In fact, one manufacturer reports better than 60% of his current production is on the double unit type.

It is a mystery to me why an electric water heater at all in any territory where gas service of any kind is available. The initial high customer investment caused by a large capacity tank, draped with expensive electrical controls, plus an installation expense itself in some instances as high as the total cost of an adequate gas automatic storage heater, creates an anomaly which is not exactly flattering to our own promotional ability.

Low off-peak rates are something, of course, but the disturbing thing is that there must be an electric range in the picture to make them really effective. And when anybody starts monkeying with our cooking load—the electric water heater is doing exactly that—we are being challenged to get up and fight for our very existence.

They Preferred Gas Refrigerators

Three people I know, within the last month, have replaced the asthmatic laboring donkey engines—at least, that's how they sounded—with brand new refrigerators. All electric! In every instance, recognizing that noises accumulate rapidly in an electric refrigerator, they said they would have preferred the silent, dependable gas job, but what the heck! None was available.

Of course, this is only a temporary condition, and there is even the consolation that they really recognized the superiority of gas refrigeration, but it is this feeling of helplessness, while competition grabs the business, that really hurts.

With all due credit to the excellent job done by our sole gas refrigerator manufacturer, the gas industry is handicapped in the face of the combined promotional activities of several first-class electric refrigerator manufacturers, whose real strength is not primarily their national advertising, but the thousands of salesmen of *independent* dealers, beating the bushes for business.

The gas industry cannot match the advertising pressure nor the sales pressure of independent dealers, because it has neither the refrigerator production facilities to support such an advertising program nor the army of *independent* dealers to make such production possible.

Low Cost Insurance

Of course, most gas sales executives would howl to high heaven if anybody accused them of being "cheap." So it won't be done on this page. though there is ample evidence that many are economically-minded at the wrong time.

Take the matter of safety devices, for example. The manufacturer's problem has always been building as cheap a device as possible to comply with the A. G. A. Laboratory minimum standards. In a temperature and pressure relief valve, the difference between minimum standard requirements and the best possible job money can buy is perhaps two or three dollars at the most. There's a whale of a lot of additional insurance in that modest premium.

The integrity of gas service merits the best, regardless of minimum standards. There is one leaf the gas industry could advantageously copy from its electric competitors, whose basic policy is never to spoil a ship for a coat of tar.

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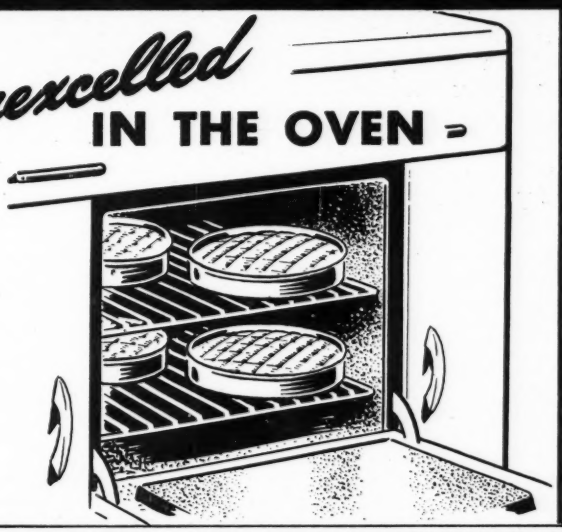

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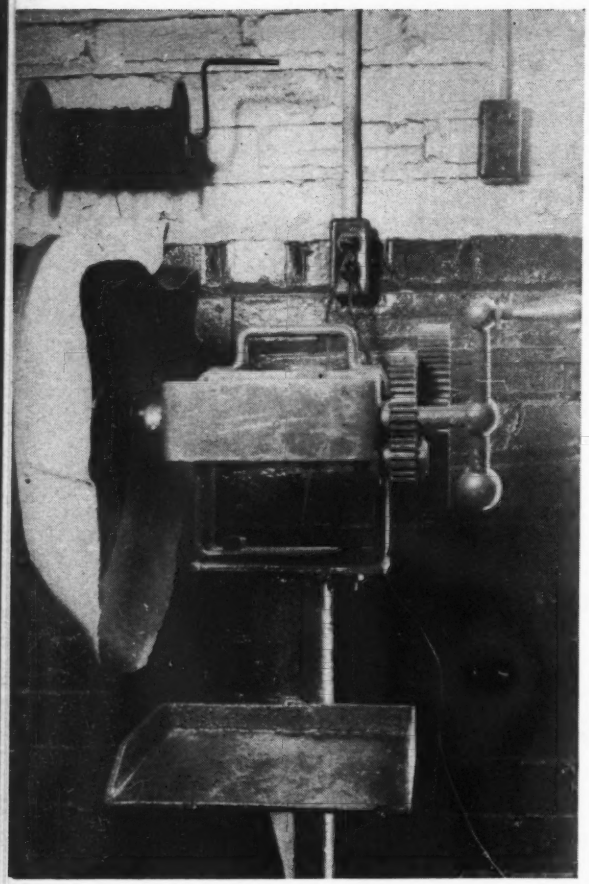
Diaphragm Wrapper

Shop-Made Machine Speeds Wire Winding on Large Emco Meters

By HOWARD W. JONES
Editor, "GASETTE"
Oklahoma Natural Gas Co., Tulsa



View of the diaphragm wrapping machine, showing completely wrapped leather ready to be removed from the pan.

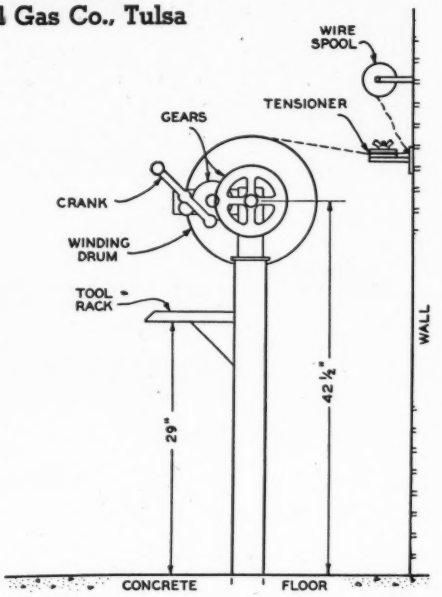
A DEVICE that has replaced hand-power with machine-power in the wrapping of leather diaphragms has increased efficiency and lopped off many man hours since it was first put into operation by the Oklahoma Natural Gas Co.'s shops in Tulsa. Designed by T. A. Roberts, and installed in the gas measurement department, it has proved its worth over a long period in wrapping leathers with wire on the pans of large Emco meters.

Roberts conceived the idea while himself wrapping leathers by hand, a tedious and difficult task.

The machine, operated by a crank, is merely a simple arrangement of gears of various mechanical advantages designed to produce sufficient leverage and a synchronized speed of the revolving pan. The machine is complete with three different-sized expansion discs for Emco Nos. 2½, 3, and 4 diaphragm pans. These discs are constructed to fit inside the diaphragm pan on the flange side. By turning the adjustment screw on the expansion disc, the disc is expanded, exerting a pressure on the inside of the diaphragm rim. The rim is held firmly while the wire is wound tightly around the leather on the revolving pan. After the wire has been wound around the leather and pan, it is cut and tied to prevent it from unwinding.

According to Gilbert Estill, head of Oklahoma Natural's gas measurement department, this diphragm wrapping machine has proved itself to be one of the most outstanding contributions to effective production in the history of the shop.

At left, operator is shown in the process of wire-wrapping a large leather onto the pan. This device is made to accommodate three sizes of diaphragms.



Sketch of the machine indicates dimensions followed in its design.

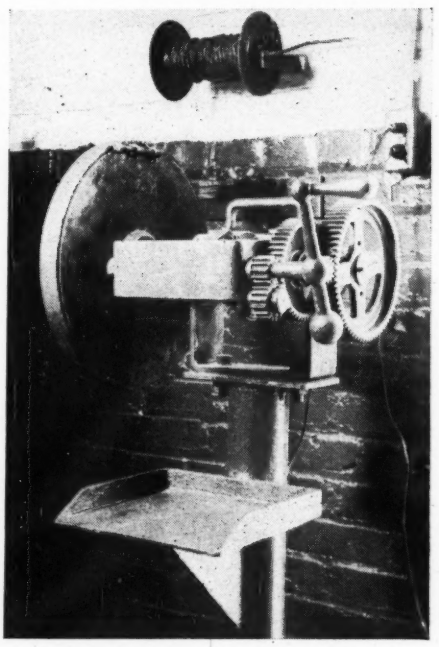


Photo shows the arrangement of gears used in the wrapper, and the expanding disc, which is screw adjusted.

DOES PULSATION PLAY TRICKS IN YOUR PLANT?

HOW TO CUT H.P. LOSSES

Pulsative flow in gas, air and vapor lines doesn't limit its effects to visible or audible vibration in plant buildings and equipment, or to inaccurate orifice meter readings. It also wastes power because compressors must overcome the reflection of the pulsation cycle in addition to keeping the gas stream moving forward.

For example—Tests conducted recently by a Natural Gas Company showed a horsepower loss of 10.3% on the crank end and a loss of 12.4% on the head end of its compressors. After installing FLUOR Pulsation Dampeners on discharge lines, *this power loss was reduced 76% on the crank end and 53% on the head end.* By eliminating pulsative flow and its adverse characteristics, the FLUOR Pulsation Dampener quickly pays for itself through the saving it effects in power cost. Only 24 hours were required to make this installation.

The FLUOR Pulsation Dampener has no moving parts. It operates with beneficial effects on friction losses, horsepower savings and rate of flow. If vibration plays *tricks* in *your* plant, it may be due to pulsative flow in air, gas or vapor lines. In that case, the FLUOR Pulsation Dampener is your answer.

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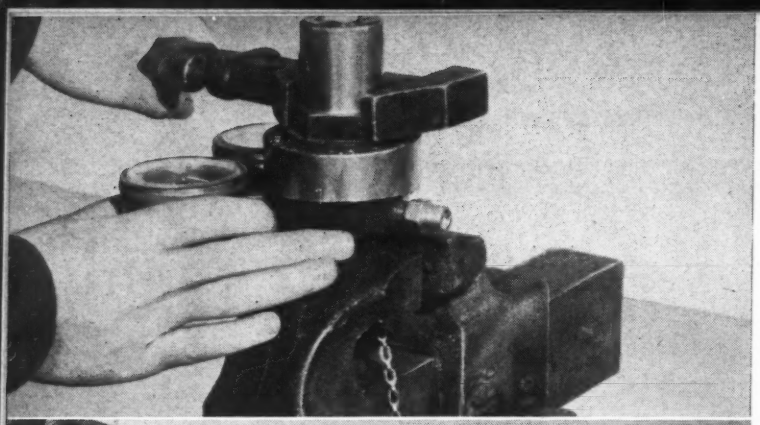
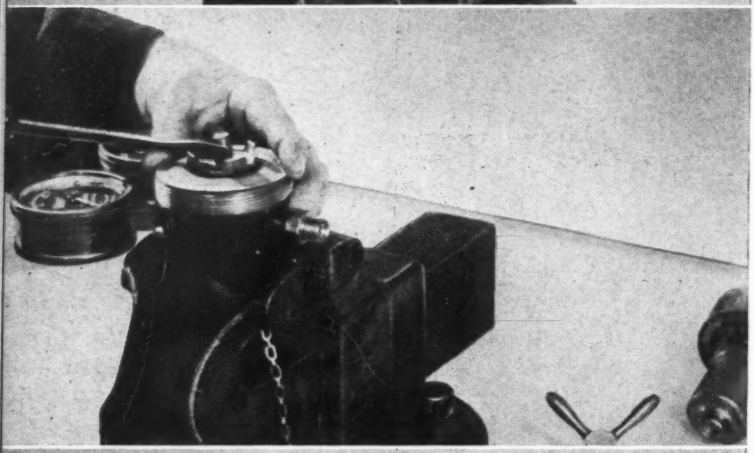
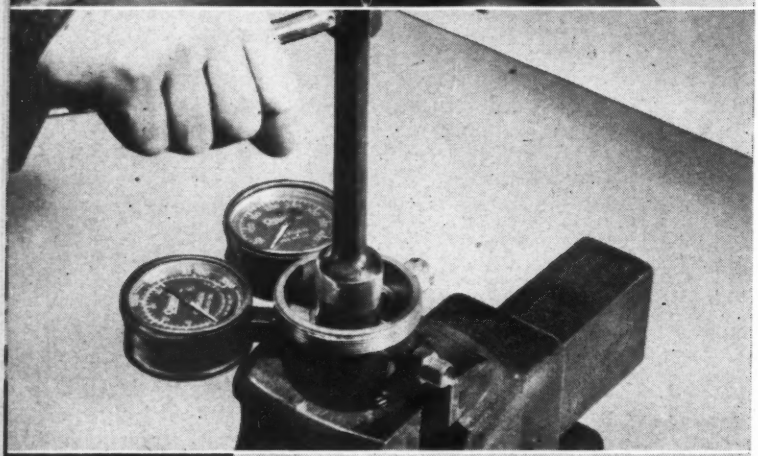
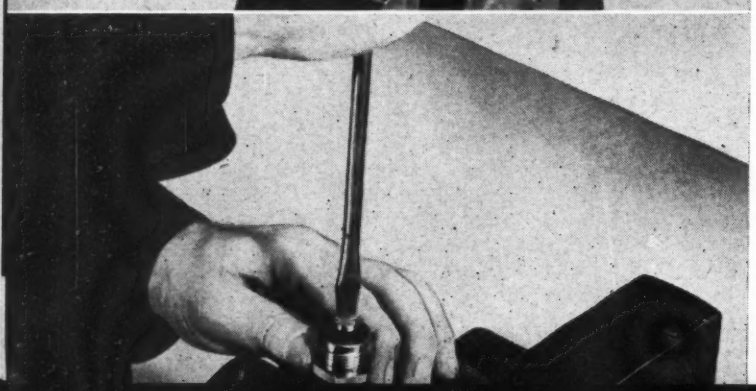








How to Adjust
WELDING TANK

1. To Remove Regulator Cap

Place the regulator in a vise with the pressure-adjusting screw up and close the vise jaws on the flat sides of the inlet connection boss. Remove the pressure-adjusting screw by turning it to the left (counterclockwise) and, using a large monkey wrench, unscrew the cap.

2. To Remove Diaphragm

Remove the cap, spring cap, pressure-adjusting spring, and diaphragm slip ring. Hold the diaphragm firmly and remove the diaphragm plate by inserting a screwdriver between one of the ears and the projection on the center of the plate and then turning it to the right. Lift off the diaphragm washer and diaphragm exposing the valve unit.

3. To Test Valve Unit for Leaks

Remove the regulator from the vise, connect it to a full cylinder of oxygen, and open the cylinder valve slowly. Stand to one side of the regulator—not directly in front of the gauge faces—when opening the cylinder valve. Test the valve unit for leakage around the valve stem and threads, using soapy water (use only grease-free soap such as Ivory soap).

4. To Remove Valve Unit

If the valve leaks, it will be necessary to disassemble the valve unit to correct the leakage. Close the cylinder valve and remove the regulator from the cylinder. Replace the regulator in the vise and remove the valve unit from the regulator with a socket wrench.

5. To Disassemble the Valve Unit

Disassemble the valve unit by holding the valve stem cap in a vise and unscrewing the stem from the stem cap. Do not grip the head of the stem; use the screwdriver slot provided. When unscrewing the stem, press down on the valve seat locking screw to move the seat off of the stem so as to avoid marring the seating surfaces.

and Repair

REGULATORS

6. To Determine Cause of Leakage

Examine the valve seat and the section of the stem which closes against the valve seat. Compare the stem with a new stem to see whether it has been bent or stretched due to leakage. Replace worn or damaged parts with new ones. If the spring is more than ⅛ in. shorter than a new one, it should be replaced.

7. To Adjust Valve Stem Cap

Adjust the fingers of the valve stem cap so that they have just enough tension, evenly distributed to support the weight of the valve seat locking screw. Reassemble the valve unit in this manner: Hold the valve stem cap in a vise. Place the valve spring in the cap and place the valve seat locking screw over the cap. Place the seat on the face of the locking screw and screw the stem into the cap. Tighten the stem firmly but take care not to bend it. Press down on the locking screw as you did in No. 5.

8. To Reassemble Regulator

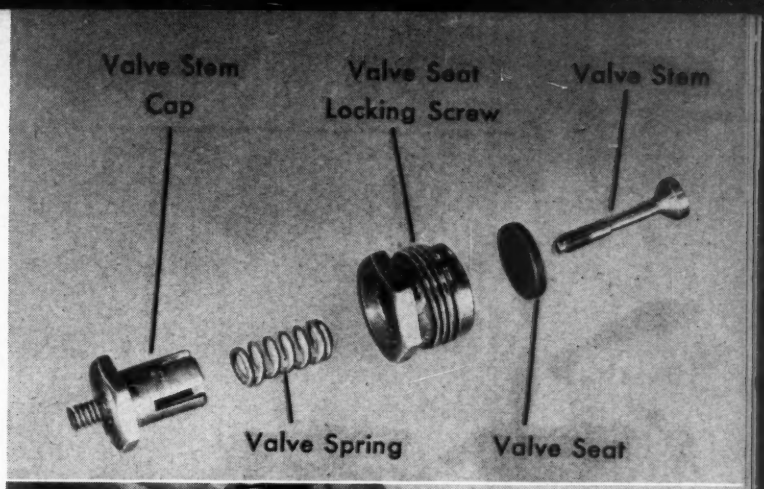
Screw the valve unit firmly into the body with a socket wrench about ¼ turn beyond the point where the unit begins to tighten. Again test for leaks. Wash both sides of the diaphragm with clean water, dry it thoroughly, and place it and then the diaphragm washer over the valve stem cap. Hold the edge of the diaphragm and screw the diaphragm plate on tightly. Put the diaphragm ring, pressure-adjusting spring, and spring cap in place and screw the cap on tightly. Replace the pressure-adjusting screw and test for leaks.

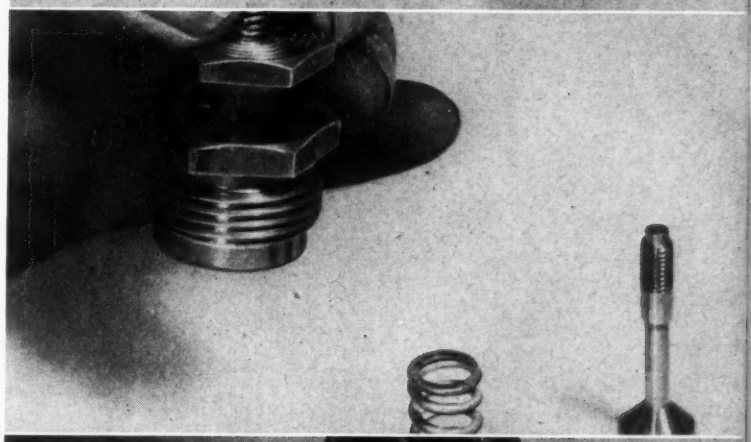
9. To Replace Safety Release Disk

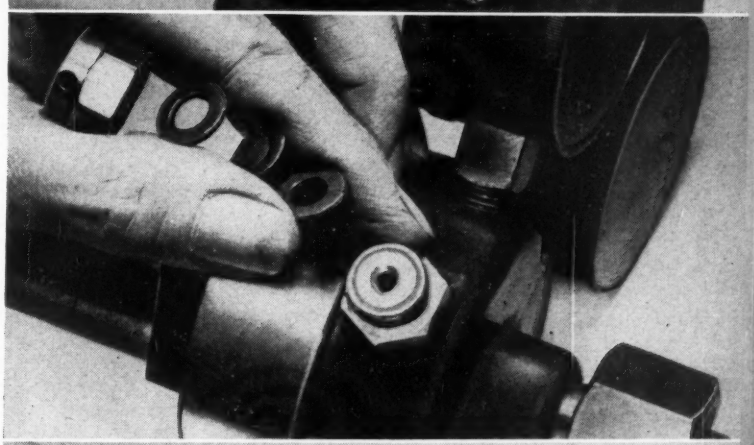
Unscrew the safety release cap and remove the two fiber washers and the disk. Wipe clean the faces of the fiber washers, place a standard safety release disk (never more than one) between the fiber washers, and reassemble. Tighten the safety release cap snugly, but do not use excessive force which might distort the disk.

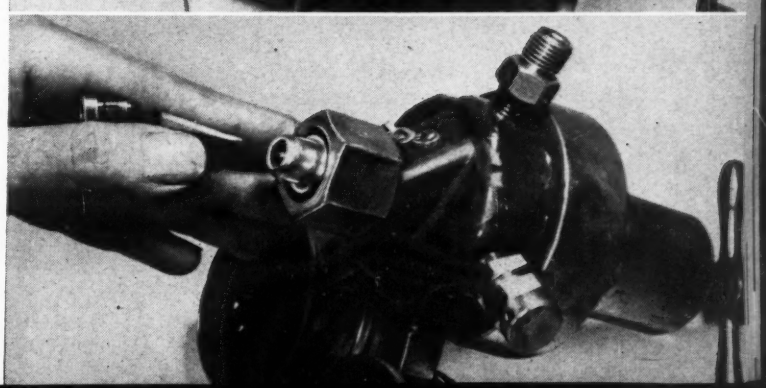
10. To Replace Inlet Filter

Remove the inlet filter locking screw in the end of the inlet nipple with a screwdriver. Turn the regulator so that the inlet nipple points downward and tap the inlet nipple lightly with a screwdriver handle. The filter will drop out. (NOTE: In older regulators this will be a wire screen as shown, but in newer regulators it may be a porous metal filter. In all cases the porous metal filter and its locking screw should be used as replacement.) Insert a new filter and tighten the locking screw firmly with a screwdriver.









COMPLETELY AUTOMATIC CONTROL FOR DISTRIBUTION SYSTEMS WHERE PEAK LOADS ARE CAUSED BY RESIDENTIAL HEATING . . .

FISHER TIME TEMPERATURE GAS PRESSURE BOOSTER

The full automatic pressure control with a Fisher Time Temperature Booster offers many advantages — plus unequalled customer satisfaction — and operating and gas savings that can quickly pay for the complete installation. It is designed to control reduced pressures in low pressure gas distribution systems and to automatically adjust that pressure in accordance with atmospheric temperature changes.

★ **Fisher Bulletin 46-A gives complete detailed information — operating principles — performance records — and prices. A copy will be mailed on request. Write today.**

What It Will Do For You—

1. Reduce "unaccounted for" gas by lowering average distribution pressure. Automatically raises and lowers distribution pressure in accordance with fluctuations in atmospheric temperature changes below 65° F.

2. Eliminate countless man hours, truck hours and mileage expense now devoted to manual adjustment of district regulators.

3. Reduce customer complaints because distribution pressures are always adequate.

4. Cut pressure to a minimum during night when load is light.

FISHER GOVERNOR COMPANY

• 845 FISHER BUILDING •

MARSHALLTOWN, IOWA

Home Service Suggests "Ideal Gas Range"

A COMPOSITE picture of the ideal gas range — designed just as the housewife would want it — has been incorporated in a set of recommendations devised by the Pacific Gas Association Home Service committee and recently was sent to all range manufacturers.

According to Cleo Filsinger, chairman of the committee, home economists connected with gas company home service departments have an excellent opportunity to learn at first hand just what women think about their gas ranges. They talk to hundreds of women about their cooking problems and their training enables them to interpret comments, both favorable and unfavorable, into whatever bearing they may have on gas range fixtures and design.

In the fall of 1945, each home economist in the Pacific Coast Gas Association submitted a list of improvements for domestic gas ranges compiled from customers' suggestions or complaints on present and new equipment in her community.

This material was compiled, studied and discussed at the annual Home Service Workshop, which was held in San Francisco March 6-7, 1946. A committee was appointed to summarize the material and submit recommendations which were sent back to department directors for discussion with their sales managers and utilization engineers.

The following tabulation represents the committee's final recommendations. The association has suggested that manufacturers make a careful study of these points and check each one against the construction and design of their own gas ranges.

Overall Range

1. Minimum number of panels to improve appearance and cleanability.
2. Insulation throughout range improved to give cooler exterior surfaces.
3. Burner box section designed so that it can be easily cleaned.
4. Appliance outlet on range.
5. Manufacturer's model and serial number in accessible position.
6. Time clocks designed to be less complicated.
7. Valve handles that lock when not in use.
8. Valve handles of material that will not discolor or conduct heat, or located so they are protected from oven and broiler heat.
9. Signal to indicate when oven temperature is reached.
10. Better workmanship on storage drawers.
11. More research on griddle burner input and design.
12. Deep well cooker designed for low temperature cooking.
13. Safety devices more accessible and out of heat zone.

Platform

1. Burner grids level with platform of range.
2. One piece platform and back splasher.
3. Grids so designed that large OR small utensils will sit securely on them.
4. Burners designed for easier cleaning.
5. Pilots located to be accessible for relighting when range is hot or cold.

Oven

1. Better workmanship in oven construction.
2. Interior of oven smooth and easy to clean. Glides should be embossed into oven lining.
3. Racks of non-corrosive material, should be smooth with bars flat and placed close together to eliminate tipping.
4. Racks should slide smoothly and lock to prevent accidents.
5. Thermostatic control on all ovens.

Broilers

1. Better workmanship in broiler compartment construction.
2. Compartment designed for easier cleaning.
3. Smokeless broiler pan with pan and rack of smooth, nonporous material for easy cleanability.
4. Broiler burner designed to be adequate for entire broiler pan area.
5. Waist-high broiler whenever possible.

Maytag "Stored Heat" Demonstrated

THE "stored heat" cooking accomplishments claimed for the new Maytag Dutch Oven gas range were tested recently by Lou Bildstein of Colorado Springs, Colo., president of the Maytag Rocky Mountain Co. Bildstein took his sales and service managers and five of his regional managers to the Maytag factory at Newton, Iowa, for a week of conferences and studies of basic manufacturing processes.

At 9:15 one morning Bildstein placed a roast in the heavily-insulated oven of a range in the sales and service department's Model Service Shop, set the thermostat and timer to turn off the gas at 10 o'clock, and left to complete his morning's engagements. He is shown here at noon as he removed the cooked roast, which was carved and served in sandwishes.

In the picture, left to right, are: Dean Landis, advertising manager; Bildstein; Edwin D. Ellis, regional manager; Roy A. Bradt, vice president in charge of distribution; Henry H. Perkins, sales manager; B. B. Turner, Dutch Oven gas range sales manager; and Joseph A. Hybl, regional manager.

Thermodynamic Properties Report

A REPORT on the chemical thermodynamic properties of the alkylbenzene hydrocarbons, prepared as part of the work of the American Petroleum Institute Research Project 44 and the Thermochemical Laboratory at the bureau, is presented in the August Journal of Research (RP1732) by William J. Taylor, Donald D. Wagman, Mary A. Greaney, Kenneth S. Pitzer, and Frederick D. Rossini.

For benzene, toluene, ethylbenzene, the three xylenes, normal propyl- and isopropylbenzene, the three methylethylbenzenes, the three trimethybenzenes, and the higher normal alkyl benzenes, values are presented for the following thermodynamic properties for the gaseous state to 1500° K: The heat-content function $(H°-H°_o)/T$; the free-energy function, $(F°-H°_o)/T$; the entropy, $S°$; the heat content, $H°-H°_o$; the heat capacity, $CP°$; the heat formation from the elements $\triangle Hf°$; the free energy of formation from the elements, $\triangle Ff°$; and the logarithm of the equilibrium constant of formation from the elements, $\log_{10} Ff$.

Equilibrium constants and concentrations are given in tabular and graphical form for the isomerization of the four C_8H_{10} alkylbenzenes and for the eight C_9H_{12} alkylbenzenes as a function of the temperature to 1500° K. Equilibrium constants are also given in tabular and graphical form for some reactions involving alkylation (addition of olefin to benzene to form alkylbenzene), cyclization (conversion of paraffin to alkylbenzenes plus hydrogen), and trimerization (of acetylene to form benzene and of methylactylene to form 1,3,5-trimethylbenzene).

Utility Sales Up

Sales of gas to ultimate consumers by gas utility companies in July increased 2.2% over a year ago, totaling 1,799,046,000 therms compared with 1,759,915,000 therms sold in July, 1945, the American Gas Association has reported.

The association's index number of total gas utility sales was 183.8% of the 1935-39 average.

For the 12 months ending July 31, 1946, sales of utility gas were 25,722,000,000 therms, a decline of 1.7% under the previous year.

Sales of mixed gas during July amounted to 72,500,000 therms, an increase of 3.7%, compared with sales of nearly 70,000,000 therms in July, 1945. Mixed gas sales for the 12 months ending July 31, 1946, gained 1.8% over those for the preceding 12-month period. The July, 1946, index of mixed gas sales stood at 164.5% of the 1935-39 average.

Manufactured gas sales in July rose 0.4%, to total 143,600,000 therms, against 143,100,000 therms a year earlier. Sales for the 12 months ending July 31, 1946, were 2,057,000,000 herms, a decline of 1.1%. The July index of manufactured gas sales stood at 142.7% of the 1935-39 average.

Utility sales of natural gas amounted to 1,582,900,000 therms, an increase of 2.3% over sales of 1,546,900,000 therms in July, 1945. For 12 months ending July 31, 1946, natural gas sales totaled 22,466,000,000 therms, a decrease of 1.9%. The association's index of natural gas sales in July, 1946, was 189.9% of the 1935-39 average.

½ INCH COMBINATION 1 PIECE BURNER (A valve) & PILOT (B valve) VALVE

This new valve incorporates many exclusive features never before found in any gas valve. Just check a few of its many advantages.

- ★ 1 piece construction, fully assembled which eliminates costly and hard to get manifold and fittings.
- ★ Speeds up production, thereby reduces production cost.
- ★ Valve is fool-proof.
- ★ Simply adapted for thermostatic control by the insertion of only one screw.
- ★ Every valve stem is lapped for precision fit.
- ★ Guaranteed leak-proof, thereby eliminating customer service.
- ★ Adaptable to all lines of gas appliances.
- ★ Designed by gas furnace manufacturing engineers for production and quality features.
- ★ First and only safety-locking plate as an integral part of valve construction.
- ★ A.G.A. approved.

LARGE PRODUCTION – IMMEDIATELY AVAILABLE

Write or wire for prices, discount, etc.

NATIONAL PROCUREMENT & SUPPLY COMPANY

834 WESTMINSTER AVENUE ALHAMBRA, CALIFORNIA

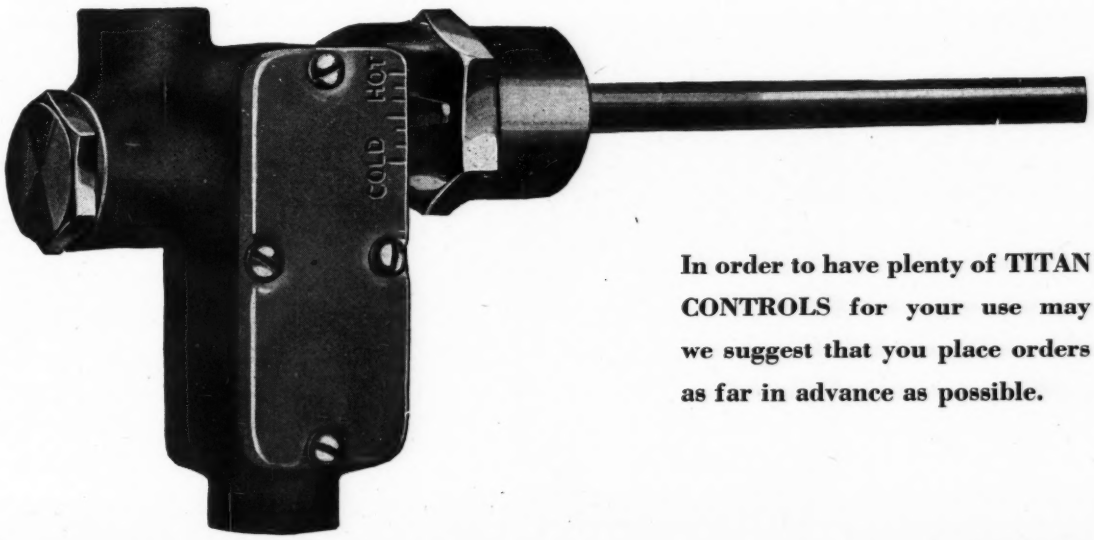
That's what happens when someone has to *remember* to light the hot water tank.

And it's so unnecessary. An Automatic Hot Water Heater supplies plenty of hot water at all times for all purposes.

Millions of homes are equipped with Automatic Hot Water Heaters now — additional millions will install them—in both new and old houses — during the next few years.

You can assure your customers of trouble-free service from their Automatic Hot Water Heaters by using

TITAN
WATER HEATER CONTROLS



In order to have plenty of TITAN CONTROLS for your use may we suggest that you place orders as far in advance as possible.

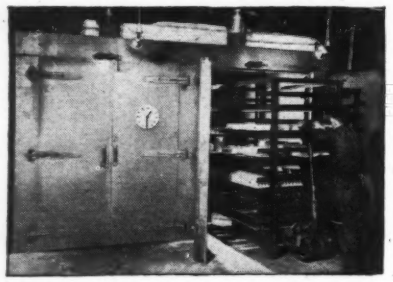
THE TITAN VALVE & MANUFACTURING COMPANY

9913 ELK AVENUE • CLEVELAND 8, OHIO

NEW PRODUCTS

Batch Type Oven

Despatch Oven Co., 619 S.E. Eighth St., Minneapolis 14, Minn.
Model: Two-section batch type oven.
Application: New type of duct system with adjustable scoop type ports provides uniform baking.
Description: This oven allows removal of objectionable fumes from the core room and reduces handling to a minimum. The 500,000 Btu heating unit is the direct gas-fired type with blower



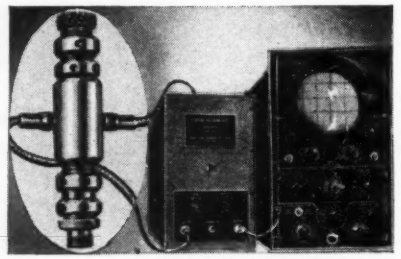
and automatic controls on the side rather than the top of the oven. Loading flexibility is provided with four racks; two small and one large, or two large. All cores, regardless of size, are well baked and maximum loading flexibility is afforded.

One user reports that flywheel cores, which used to require three hours to bake (and then some were burned and some green), are now baked in two hours with perfect uniformity. This represents a saving of 35% in core baking time and prevents losses due to baking.

Pressure Time-Curve Indicator

Electro Products Laboratories, 349 W. Randolph St., Chicago 6, Ill.
Model: Pressuregraph Pressure Time-curve Indicator.
Application: Used for Diesels, C.F.R. aviation fuel test engines, internal combustion engines, compressors, pumps, air and liquid pipe lines, 2-cycle engines and other types of equipment, the Pressuregraph provides, with a cathode ray oscillograph, a substantially linear pressure-time curve on the screen, which indicates the performance of any device subject to pressure variations. It indicates the erratic operation of devices which normally cannot be measured by other means due to inertia of flywheels or the operation of other factors. It also reveals static or slow pressure variations. It covers all mechanical speeds and pressures up to 10,000 psi.
Description: The new Pressuregraph provides means for temperature compensation. There are three output selections: 1) for double modulated wave; 2) for indicator card wave, and 3) integrated single line providing means for transmission of pick-up response to a string oscillograph, for photographic recording.

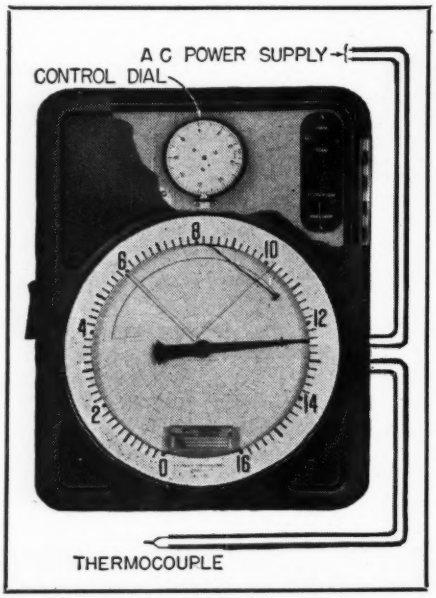
The completely redesigned pick-up has been made vibration-proof, and is furnished with or without water cooling. Operation is accomplished through a single control. The pick-up is inserted in cylinder, chamber of airline, etc. The pick-up includes a



diaphragm which, when acted on by pressure impulse, unbalances an electronic circuit. The unbalanced voltage from the pick-up is delivered to the Pressuregraph cabinet where it is amplified, and passed through a negative modulation suppressor, and then to the oscillograph. The sweep circuit of the oscillograph is adjusted to the speed of the engine of mechanism under test. A band of light appears on the screen, the contour or shape of which light is the true pressure-time curve.

Potentiometer-Pyrometer

Bailey Meter Co., Cleveland 10, Ohio.
Model: Electronic Potentiometer-Pyrometer.
Application: For continuously recording one or two temperatures on a 12-in. diameter uniformly graduated chart.
Description: This recorder operates from a thermocouple or from any



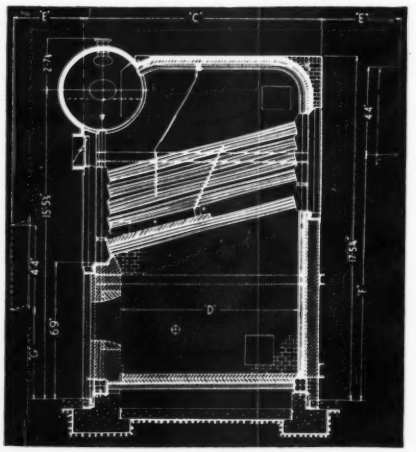
source of d/c potential which varies through at least 10 millivolts for full scale range. Trouble-free service and a minimum of maintenance are insured by the elimination of many moving parts. Only the recording chart moves continuously. Panel space may be saved by installing two controllers, operated from separate circuits, in the same recorder casing.

These recorders are available for air-operated, on-off electric type, and throttling type control systems. The instrument illustrated is cut away to show the control dial by which the set point may be adjusted to any desired temperature. This is used for on-off and throttling type controls.

Further information is available in bulletin No. 232.

Water Tube Boilers

Springfield Boiler Co., 1919 E. Capitol Ave., Springfield, Ill.
Model: Springfield Type M Series.
Application: This line of 12 standard water tube boilers ranging in guaranteed steam generating capacity from 6000 to 17,000 lb. of steam per hour, is particularly successful where it is necessary to maintain uniformly high efficiency over a wide range of load conditions. Special advantages claimed by the manufacturer are simplicity of maintenance, minimum number of parts, ability to operate considerably above rated capacity, dry steam and



freedom from priming.
Description: Type M boilers are made with two standard tube lengths, 10 ft. and 12 ft. expanded into sinuous electric steel sectional headers. Furnace width varies from 3 ft. 9 in. to 9 ft., depending upon whether from four to ten header sections are used. All boilers in the line have 48-in. diameter welded, X-rayed, stress-relieved steam drums built to pressure standards from 160 to 320 lb. Overall height is 17 ft. 5¼ in. for all units.

Silicone Resin

Dow Corning Corp., Midland, Mich.
Model: DC 804, thermosetting silicone resin.
Application: For use in the formulation of hard, mar-resistant white finishes which will resist heat and weather and will not yellow with age. Similar to the company's DC 803, the new resin forms a tougher film and requires less baking to produce a harder and more mar-resistant surface.
Description: The new resin resists temperatures up to 500° F. Its specifications are: resin content by weight, 60%; solvent, toluene; viscosity, in poises at 25°C, 0.3 to 1.0; specific gravity, at 25°C, 1.060; density in lbs. per gal., 8.75; color, straw.

Legal Holiday

. . . NOT ON PIPELINES protected with NO-OX-ID and NO-OX-IDized wrappers . . .

Electrical testing reveals no holidays on this NO-OX-ID-protected pipe. Regardless of your protection problem, NO-OX-ID protection is available to end corrosion troubles.

Pits or corrosion present at the time of application are deactivated by NO-OX-ID. Corrosion cannot start beneath these coatings. And outside moisture cannot readily penetrate NO-OX-IDized wrappers; cannot reach the pipe or shorten its life. NO-OX-IDized wrappers are heavily reinforced for permanence, and impregnated with NO-OX-ID for complete lasting protection.

Applied hot or cold, by hand or by traveling machine, NO-OX-ID and NO-OX-IDized wrappers shut the door on corrosion—your assurance that when pipe goes down, it is down to stay.

The ORIGINAL RUST PREVENTIVE

Dearborn Chemical Company
Dept. B, 310 S. Michigan Ave., Chicago 4, Ill.
New York • Los Angeles • Toronto

PEOPLE

L. Ruthenburg

• **Louis Ruthenburg,** president of Servel, Inc., Evansville, Ind., has been appointed to the Labor-Management Advisory Committee of the United States Conciliation Service, according to an announcement made recently by **Edgar L. Warren,** director of the service. Ruthenburg was selected by the U. S. Chamber of Commerce to succeed **David Sarnoff,** president of the Radio Corp. of America, who resigned.

• **Frank J. Bischoff,** who has been controller of Consolidated Edison Co. of New York, Inc., New York City, for the past 23 years, was elected a vice president of the Westchester Lighting Co., part of the Consolidated Edison System, on Sept. 10. **Charles E. Eble** was elected controller of Consolidated Edison and was also appointed controller of the New York Steam Corp. **John V. Cleary** was appointed senior assistant controller of Consolidated Edison and will be in charge of the company's general accounting department. On Oct. 1 **Arthur E. Hald** became auditor, replacing **Reuel O. Launey,** retired. **B. S. Rodey,** associate controller, has been placed in charge of the company's tax department.

• **Frank C. Smith,** president of Houston Natural Gas Corp., Houston, Texas, has been appointed Texas state as well as Houston community chairman of the Committee for Economic Development, according to an announcement by **Walter Fuller,** chairman of the newly-formed CED national information committee. **C. B. Tingley,** division manager of the Kansas Gas & Electric Co., has been appointed CED community chairman for Arkansas City, Kan.

• **H. D. Nicholson** has been appointed the new representative of the American Gas Association to the motion picture and radio industries in Hollywood, continuing the work developed by **Deke Houlgate** in this special contact activity. Nicholson was with the training staff of the sales department of Southern California Gas Co. prior to the war and served in the navy for four years.

• **General Brehon Somervell,** president of Koppers Co., Inc., Pittsburgh, Pa., recently announced new executive appointments for six vice presidents of the company. **W. Reed Morris** became general manager of the gas and coke division; **M. T. Herreid** is manager of Koppers plants at Granite City, Ill., and St. Paul, Minn.; and **J. F. Byrne** will be on special assignment for the engineering and construction division. **J. N. Forker** is general manager of the tar products division, **Dan M. Rugg** became general manager of the chemical division, and the new manager of the finance department is **Stanley N. Brown.**

The appointment of **Kenneth R. Hare** as manager of the Seaboard plant of the gas and coke division was also announced, Hare has been sales manager of the Seaboard plant since 1928.

• **Janet Armstrong** has joined the staff of the Homemaker's Institute at Servel, Evansville, Ind., as assistant director of home economics research. Miss Armstrong, who has received her master's degree in home economics from Purdue university, has been working with Purdue staff members on a household research problem for LIFE magazine for the past nine months.

• **P. E. Fluor,** chairman of the board of directors, The Fluor Corp., Ltd., has announced the resignation of **J. S. Fluor, Jr.,** executive vice president and general manager. The resignation was effective as of Sept. 1.

H. E. Jalass

• **Harold E. Jalass** has been appointed assistant general sales manager of Cribben and Sexton Co. it was announced recently by **John E. Bogan,** vice president in charge of sales. Jalass joined Cribben and Sexton in 1917 and entered the sales department in 1922. For the past 15 years he has been district manager for Universal gas ranges in the Metropolitan Chicago area. He will continue in this capacity, in addition to his new duties.

Wilfred H. Roy has been named assistant to the general production manager for Rheem Manufacturing Co. with headquarters in New York City. Roy joined Rheem at the company's Stockton, Calif., plant in 1942 and recently has been staff assistant at the South Gate plant in California.

• Appointment of **Ernest S. Theiss** as assistant chief engineer of the Davey Compressor Co., Kent, Ohio, was announced recently by **Paul H. Davey,** president. For the past seven years Theiss has served as assistant professor, Mechanical Engineering department, College of Engineering, Duke University.

• **Edward C. Logelin, Jr.,** has been appointed director of public relations, U.S. Steel Corp. subsidiaries, Chicago district, according to a recent announcement by **J. Carlisle MacDonald,** assistant to the chairman of the board. He succeeds **Arthur C. Wilby,** newly-elected vice president.

• The G. S. Blodgett Co., Inc., Burlington, Vt., has announced the appointment of **Paul C. Grimes** as midwestern representative for Blodgett baking and roasting ovens. He will cover the states of Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota and Iowa and the cities of St. Louis, Mo., and Pittsburgh, Pa.

• **Charles Kramer,** district manager of the Waverly plant of United States Steel Supply Co., Newark, N. J., has retired, according to **Leslie B. Worthington,** president. Kramer's 46 years of U. S. Steel service began in 1900 with Carnegie-Illinois Steel Corp. in Pittsburgh. He is succeeded by **William J. Norman,** who joined U. S. Steel in 1912.

• **Malcolm McLean** and **Raymond A. Bissell** have been appointed district representatives for The Bryant Heater Co., Cleveland, Ohio, in the New York area, according to **James Crawford,** sales manager. McLean was previously connected with the Westchester Lighting Co., and Bissell was district house heating supervisor of the Brooklyn Union Gas Co. for 14 years.

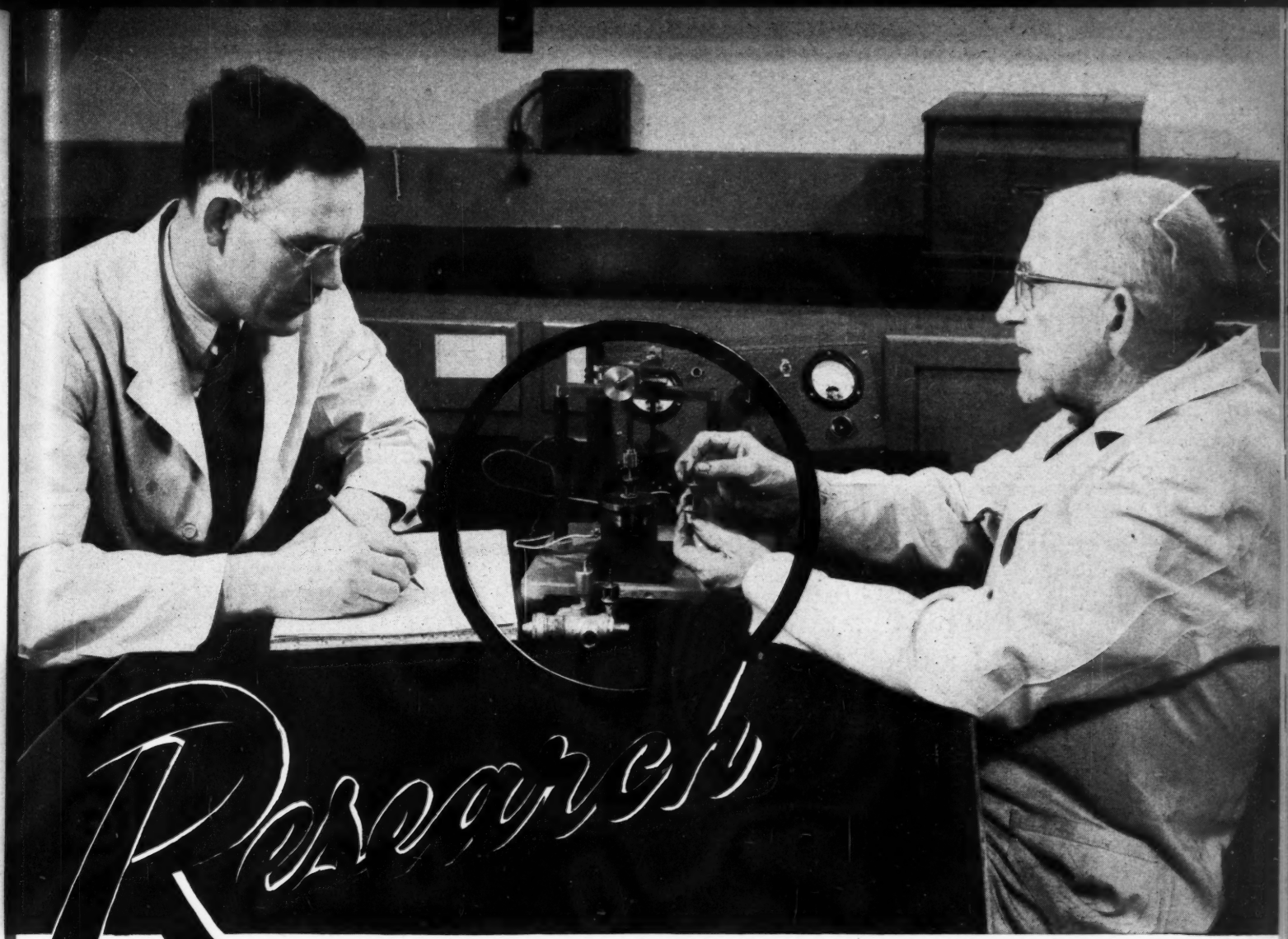
• **E. R. Gilmore,** who has been chief engineer of Emco products, has been appointed chief engineer of the Pittsburgh Equitable Meter Division of Rockwell Manufacturing Co. Gilmore will be in charge of engineering and development of the meters and regulators built by the division. He joined Pittsburgh Equitable in 1936.

• **Henry J. Wallace** has been appointed general manager of sales for National Tube Co., U. S. Steel subsidiary. He succeeds **W. F. McConnor** who recently was elected National Tube vice president in charge of sales. Wallace has served with the company in various capacities since 1928, and since 1945 he has been sales manager of the eastern area.

• **Thomas H. Evans** has been appointed a supervisor in the commercial heating sales section of the Equitable Gas Co., Pittsburgh, Pa. He will supervise commercial heating salesmen covering half of the territory served by the company. Evans served 3½ years in the army.

H. A. Size

• **D. A. Campbell,** industrial division manager, Bryant Heater Co., Cleveland, Ohio, has announced the appointment of **Homer A. Size** and **Arthur K. Nelson** as representatives of the division. Size, who was formerly with Michigan Consolidated Gas Co., will represent Bryant in California. For the past two years he has been partner and manager of Immerson Heating Equipment Co., Los Angeles, and he will continue this association. Nelson, who has just completed three years with the navy, was formerly with Minneapolis Gas Light Co.



ADVANCES BASO DEVELOPMENT

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•

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Research is the forerunner of performance. Without accurate scientific knowledge product performance cannot be predicted. Our own laboratory scientists painstakingly test, measure, evaluate and examine every bit of material entering into the production of a BASO Automatic Pilot. Thousands of successful performance records testify to the importance of this method of pre-testing BASO quality. The BASO Thermo-Electric Pilot is built to safeguard your gas-fired equipment against all types of hazardous pilot flame conditions.

Send for Bulletin SC 300 "Application of BASO'S"

MILWAUKEE GAS SPECIALTY CO., MILWAUKEE 3, WIS.

Export Division Formed

G. S. Blodgett Co., Inc., Burlington, Vt., manufacturer of commercial cooking equipment, has announced the formation of an export division. The new division, under the management of Richard Eisenmann Export Co., is located at 11 West 42nd St., New York City.

New Standards Approved

The A.G.A. Approval Requirements Committee has adopted addenda to American Standard Approval Requirements for Hotel and Restaurant Ranges, Unit Broilers and Deep Fat Fryers, consisting chiefly of additions to cover approval under conditions of high altitude. The additions have been submitted to the ASA Board of Examination for recommendation to the Standards Council on Approval.

Brooklyn Union to Use Armored Car Service

On Sept. 3 The Brooklyn Union Gas Co., Brooklyn, N. Y., discontinued its method of depositing daily collections by special representatives or tellers and contracted for the services of the Wells Fargo Armored Service Corp. in transporting deposits to the banks. Wells Fargo is presently handling all deposits for the company's branch offices.

Rheem Hume, Ltd., To Operate at Singapore

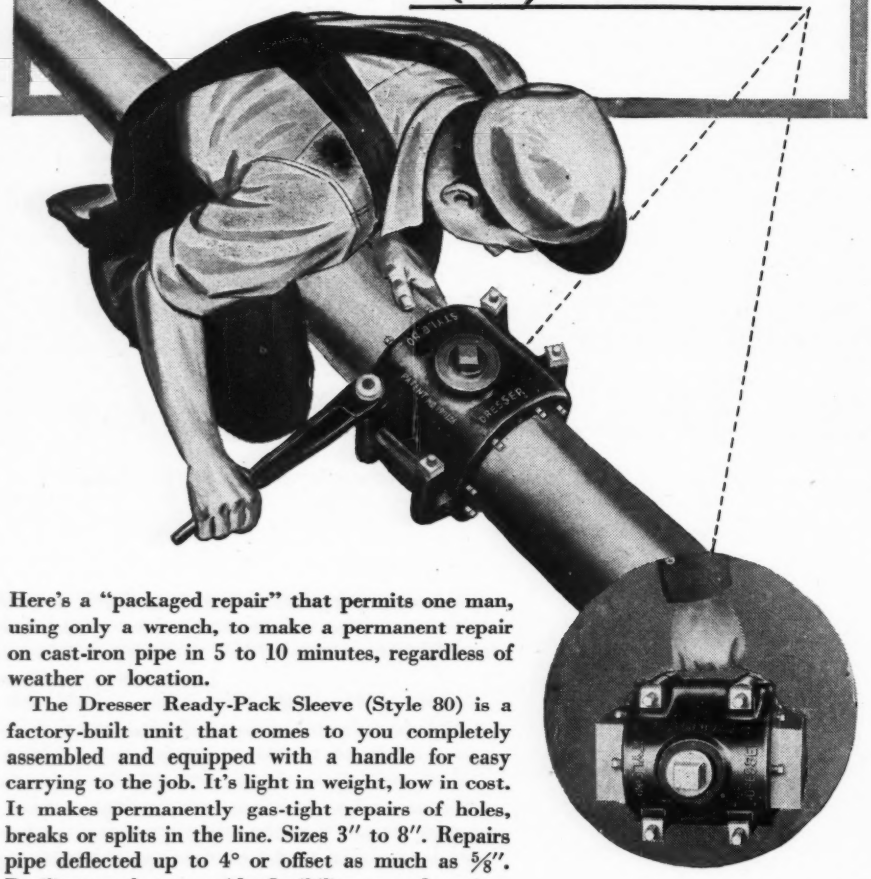
Rheem Manufacturing Co. and Hume Pipe Far East, Ltd., subsidiary of Hume Pipe Co. of Australia, have joined to form Rheem Hume, Ltd., to operate a steel shipping container plant at Singapore, Malay Peninsula, for the petroleum, latex and palm oil industries. The company, organized during a recent visit to Singapore of W. E. Zander, Rheem vice president, is capitalized at $400,000.

Hume Pipe will provide plant and management. Machinery from Rheem's Stockton, Calif., plant is being installed, and production is scheduled to begin in October.

Republic's Earnings Rise

Republic Natural Gas Co., $14 million Dallas corporation, reports an earned net income after taxes of $1,779,403 for the year ending June 30, 1946. These earnings compare with $1,492,015 for 1944-45 and $1,005,661 for 1943-44. The earnings of the natural gas division, after royalties, operating expenses, depletion and depreciation, amounted to $1,259,743 as compared with $1,016,863 for the preceding year.

A permanent pipe repair in 10 minutes with this handy *Ready-Pack Sleeve*



Here's a "packaged repair" that permits one man, using only a wrench, to make a permanent repair on cast-iron pipe in 5 to 10 minutes, regardless of weather or location.

The Dresser Ready-Pack Sleeve (Style 80) is a factory-built unit that comes to you completely assembled and equipped with a handle for easy carrying to the job. It's light in weight, low in cost. It makes permanently gas-tight repairs of holes, breaks or splits in the line. Sizes 3″ to 8″. Repairs pipe deflected up to 4° or offset as much as 5/8″. Resilient gaskets provide flexibility, guard against recurrence of break. Write for information.

DRESSER MANUFACTURING DIVISION, BRADFORD, PA.
Houston Office and Warehouse, 1121 Rothwell St., Sec. 16, Houston, Texas. In Canada, Dresser Manufacturing Co., Ltd., 60 Front St., West, Toronto, Ontario.

DRESSER READY-PACK SLEEVES
ONE OF THE DRESSER INDUSTRIES

Obituaries

• **Thomas E. Ratcliff,** 70, retired vice president and treasurer, Standard Gas Equipment Corp., Baltimore, Md., died Aug. 7. Ratcliff began his career in 1911 as assistant manager of the Baltimore Gas Appliance and Manufacturing Co., which later became part of the Standard Gas Equipment Corp.

• **Walter S. Landon,** chief engineer, oil burner controls division, Detroit Lubricator Co., Detroit, Mich., died Aug. 21. Landon had been with the company for 23 years and was recognized by the industry as an outstanding authority on oil burner control design.

• **John E. Cronin,** 56, supervisor of the (Pittsburgh, Pa.) Equitable Gas Co.'s geological department, died Sept. 10. Cronin was a brother of **Ray Cronin, Jr.,** Associated Press foreign news editor in San Francisco, and Philippine correspondent when Manila fell to the Japs.

F. A. Allen

• **Fred A. Allen,** of the Los Angeles branch of the A.G.A. Testing Laboratories, died very suddenly of a heart attack at 2 p. m. Sept. 17 while he was at work. Allen had been connected with the American Gas Association since 1930, when he joined the Cleveland Laboratories. In 1931 he went to Los Angeles as assistant supervisor of the Pacific Coast branch, the position he had held ever since. Allen was a resident of Glendale, Calif., and is survived by his wife, Alice, and a brother, John.

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Philgas Division

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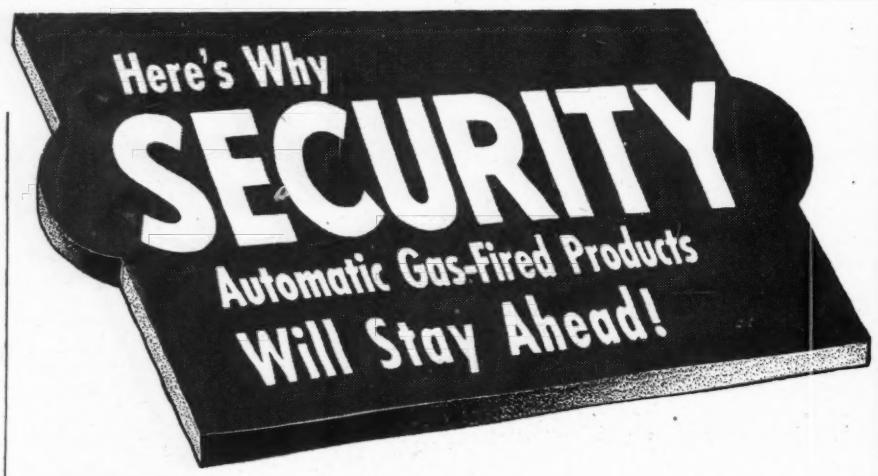
CURRENT READING

M. I. M. A. News — The Magnesia Insulation Manufacturers Association, 1317 F Street, N.W., Washington, D. C., has released the first issue of a new quarterly publication designed as a helpful medium of contact between the users and the manufacturers of 85% magnesia insulations. The publication will seek to supply information about heat insulations to industrial users through articles describing unusual applications of the product, its contribution to economy and its aid to industrial efficiency by the elimination of unnecessary heat waste.

United Gas Pipe Line's New Radio-Telephone Network Speeds Company Communications—O. C. Irvine. "Petroleum Engineer," June, 1946, pp. 142, etc. Describes design providing for two-way transmission and reception with three fixed stations and 44 mobile units.



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President

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Horizons are unlimited at SECURITY. The dynamic leadership of President W. T. Rasch and his staff moves forward . . . at an ever increasing pace. Automatic gas-fired products . . . Winter Air Conditioners, Hot Water Heaters, Gravity-type and Floor Furnaces finer than ever before are are rolling from war-enlarged production lines. Each is an example of the forceful application of knowledge and skill gained in over 40 years of design and manufacture . . . painstaking laboratory research and testing . . . the use of finest materials. Now, and in the future, you can look to SECURITY for leadership.

Lee W. Rasch
Vice-President

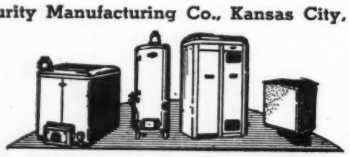
A. S. White
Vice-President

R. R. Cole
Vice-President

C. W. Hazelton

A HINT OF THINGS TO COME! Final tests are completed . . . production lines are being made ready . . . soon you will hear about SECURITY'S revolutionary NEW automatic, gas-fired products.

Security Manufacturing Co., Kansas City, Mo.



SECURITY

GAS FIRED SGP Line **PRODUCTS**

The "LONG-LIFE" LINE

Condensate from Natural Gas Yields Motor Fuel Directly — G. G. Brown. "National Petroleum News," June 5, 1946, pp. R-436, 438. Condensate, the new liquid product being produced from natural gas in high-pressure recycling plants, can yield a motor fuel suitable for sale directly to the ultimate consumer. It need not be sold as a blending agent. Condensate is secured in much the same manner as natural gasoline, but was a wider boiling range. Because of this it can be fractionated as desired to secure finished motor fuels of satisfactory volatility without blending. These motor fuels, either standard or premium grade, meet the new federal specifications and are competitive with fuels now sold in certain areas of the country. In addition, they are low in sulfur, free from gum, and have good lead susceptibility.

International Petroleum Outlook in Relation to Operations in the United States—C. O. Willson. "Oil and Gas Journal," June 8, 1946, pp. 65-69. It is the purpose of this paper to summarize briefly the production, consumption, and transportation position of the world oil business, pointing out those conditions that appear basic in determining future trends in both domestic and foreign operations. This discussion is not concerned with the economic objectives of pending treaties or possible political developments which later bring about changes in the flow of world petroleum supplies and demands in a manner not determinable at this time.

How Cathodic Protection Prevents Pipe and Tank Corrosion — "Power Plant Engineering," June, 1946, pp. 83-85, 90. Theory of cathodic protection; advantages; the cathodic protection battery; preliminary steps to installation; conducting a current survey for a pipe line; test points; pipe-to-soil potential; current required for protection; ground beds; current sources; current density requirements for tanks; effect of ice on corrosion; record of protection system for a tank; costs.

New Oxidizing-Reducing Process—G. W. Birdsall. American Gas Association Information Letter No. 6, which was sent to members of the Industrial and Commercial Gas Section, included a reprint from "Steel" of an article on the Kolene Process developed by the Kolene Corp., Detroit. The process is used in many production techniques such as porcelain enameling, silver soldering, brazing and tinning.

Patents and the Manufacturer—National Association of Manufacturers, New York 20. This booklet contains extensive information on the patent system and reforms recommended by NAM following long study and research. One section is devoted to a patent quiz which lists 25 common questions about the patent system and supplies the answers.

The Uses of Propane in Gas Manufacture—B. C. Blizzard. The author discusses advantages of the propane-air process for small town operations from an oil company's point of view. He outlines the history and growth of the relationship between the natural gas industry and the liquefied petroleum end of the oil business.

4 IMPORTANT BULLETINS

TO HELP SECURE MAXIMUM COMBUSTION EFFICIENCY *at Lowest Cost!*

N. G. E. MULTIPLE VENTURI TYPE 10-X BURNER
This bulletin shows a typical installation, typical arrangement of No. 10-X Multiple Venturi Burners, pressure table, operating features and instructions for ordering.

N. G. E. BLUE FLAME GAS BURNERS
This covers Burner Numbers 5—11—401-X. For natural or liquefied gases—low or intermediate pressures, as used for firing vertical boilers, kettles, melting pots, cleaning tanks, and other industrial operations.

N. G. E. NEWEST RADIANT HEAT GAS BURNER—No. 315-S
This bulletin gives you full information covering vertical burner application for cast iron and steel firebox boilers. For natural gas—low or intermediate pressures.

N. G. E. VENTURI TYPE GAS BURNERS
For intermediate or high pressure burners—as used for firing boilers, kilns, stills, retorts, furnaces, and for other industrial applications. Shows many burners: Types R and K and Nos. 11-B, 10XB, 14, 16, 16X, 354, and Pilot Burners.

The four bulletins shown above cover a wide range of industrial applications. They are designed to be of specific assistance to you and to illustrate the scope of the manufacturing and engineering covered by Natural Gas Equipment Incorporated. We invite your inquiries on any gas heating problem, and offer you the full co-operation of experienced gas engineers to insure the best performance of the entire gas and control installation.

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CURRENT READING

The Use of Tension in Sizing Small Diameter Seamless Pipe and Tubing—S. W. Stouffer, assistant chief engineer, National Tube Co. Illustrated discussion of why and how tension is used in the final sizing operation on the hot mill in the manufacture of small diameter hot rolled seamless pipe and tubing. Application of this principle permits substantial reductions in wall thickness of the tube in the sizing operation and also provides a means for making exceptionally large reductions in the diameter of the tube with a relatively small number of roll stands.

New Cycling Plant Conserves Gas—Produces 300,000 Gallons of Products Daily—A. L. Foster. "Oil and Gas Journal," June 1, 1946, pp. 61, 62, 75. Conservation of the entire raw products of the Sheridan condensate field, Colorado county, Texas, is the purpose and design of the Shell Oil Co., Inc., plant located 80 miles west and 20 miles south of Houston. One of the undesirable features of most large oil and gas fields in the past has been the inevitable use of flares in which to burn excess gas which must be produced, also inevitably, with the oil or distillate. The Shell plant at Sheridan, like other modern plants of this general type, has eliminated waste by recovering all of the liquefiable products which is practicable, including propane for liquefied petroleum gas. It conserves the stripped gas and makes it do the work of bringing up more distillate, natural gasoline, and liquefied petroleum gas and returning it to the formation as a cycling system of operation. In its design the various products are separated and fractionated to the required commercial standard purity. Stripped gas is returned to five input wells arranged according to a preconceived pattern, under conditions mentioned in the article.

Simultaneous Determination of Hydrogen Sulfide and Carbon Dioxide in a Continuous Gas Stream—C. L. Blohm and F. C. Risenfeld. "Ind. and Engr. Chem., Anal. Ed.," June, 1946, pp. 373-376. A method is described for the simultaneous determination of hydrogen sulfide and carbon dioxide in a continuous stream of natural gas. The two acidic gases are absorbed in standardized iodine and barium hydroxide solution.

Correct Sizing of Natural Gas Transmission Lines — G. R. Adams. "Oil Weekly," June 24, 1946, pp. 106, etc. Correct sizing of gas lines in the oil field presents an economic and engineering problem.

Materials for Safety Wearing Apparel—U. S. Dept. of Commerce, National Bureau of Standards. The Division of Trade Standards has announced that this booklet has been accepted by the trade in general as its standard of practice for new production beginning last May. The pamphlet contains a complete list of commercial standards and acceptors. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at 5 cents per copy.

Petrochemistry Directs Natural-Gas Conversion at Lion Oil Co. Plant—A. L. Foster. "Oil and Gas Journal," June 22, 1946, pp. 98, etc. Lion Oil Co.'s huge plant at El Dorado, Ark., starts with natural gas as the basic raw material. Ammonium nitrate pellets, for fertilizer, will be a principal product among the literally hundreds that can be made. The plant and process are described and illustrated.

Construction of New Compressor Stations on Texas to West Virginia Gas Pipe Line—H. Dawe. "Petroleum Engineer," June, 1946, pp. 57-60, 62. Part 1.

Illinois Gas Sales Cut To Protect Winter Supply

To insure an adequate supply of gas to present consumers next winter, the Illinois Commerce Commission recently granted authority to Public Service Co. of Northern Illinois to limit gas sales to new industrial, commercial and residential house heating customers. Similar authority has also been granted to the Peoples Gas Light and Coke Co. and to Western United Gas and Electric Co.

This curtailment was necessitated by rising demands for gas coupled with warborn delays in expansion of the pipe line bringing gas from the Texas Panhandle to the Chicago area. Gas demands of the area on peak days next winter are now estimated to require the total capacity of the pipe line plus full production from all gas manufacturing plants.

American Standards Assn. Honors Laboratories

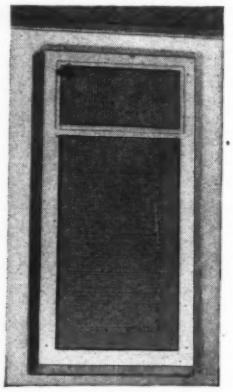
The American Standards Association recently awarded a certificate of recognition honoring the A.G.A. Testing Laboratories war committee for the development of standards for army and navy equipment and procedure. The association and its war committee members were commended for aiding in simplifying products, promoting interchangeability of repair parts, and sponsoring better procedures and higher standards of manufacture through war standards, which resulted in the saving of time, money and material.

R. M. Conner, A.G.A. Laboratories director, received the certificate at an award dinner held at the Officer's Club of the Brooklyn Navy Yard.

GAMA Appoints Agency

Donahue & Coe, Inc., has been appointed advertising counsel by the Gas Appliance Manufacturers Association. Extensive plans to promote "CP" automatic gas ranges during the coming year are now being prepared.

The Williams
WALL WARMOLATOR
for New Residences
For Natural, Manufactured or Butane Gas



Dual type. 45000 B.T.U. input. Color, light Ivory, with Automatic Temperature control with Wall Thermostat, or for manual control with pilot lighter. Easily installed—Working parts easily accessible. For 2x4 inch studs. No pit or basement. Approved by A.G.A. Eligible for F.H.A. loans.

Size of face, 25¼" wide, 50" high. Size of recess in wall, 23¾" x 48" high. Projection from wall 4".

Ask for circular, form 211

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3115 Beverly Blvd., Los Angeles 4, Calif.
Factory: 1821 Flower Street, Glendale 1, Calif.

WANTED

Gas Sales Engineer preferably with Gas Utility Experience. For sales and design of installations GASAIR Propane - Air Plants to Utility and Industry. Equipment now in thirty-one states. Bright future for aggressive man. Suitable salary and expenses.

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GAS PLANT EQUIPMENT AVAILABLE

Blowers, compressors, boilers, boosters, water and oil pumps, oil storage tanks, purifiers, cast iron fittings, 4 to 16 valves and misc. IMMEDIATE DELIVERY. Write for list.

Pennsylvania & Southern Gas Co.
P.O. Box 270, Westfield, N.J.

HELP WANTED—MALE

DISTRICT MANAGER: Location Pacific Northwest, territory serving 1,600 consumers. Knowledge of manufacture of carburetted water gas necessary. Also would have charge of distribution system. Write giving full details as to age, education, experience and availability.

Box 850, GAS,
1709 W. 8th St., Los Angeles 14, Calif.

GAS ENGINEER WANTED

Gas Engineer with experience on layout and operation of manufactured gas plants and distribution systems wanted by general gas engineering organization. Reply giving details of age, education and experience.

Box 750, GAS, 1709 W. 8th St.,
Los Angeles 14, Calif.

POSITION WANTED

EXECUTIVE—Over 15 years experience in utility rates, plant reclassification, property records, valuation and accounting. Desire permanent position with natural gas company in south or southwest. Minimum salary $7,200.00.

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More Women Cook on

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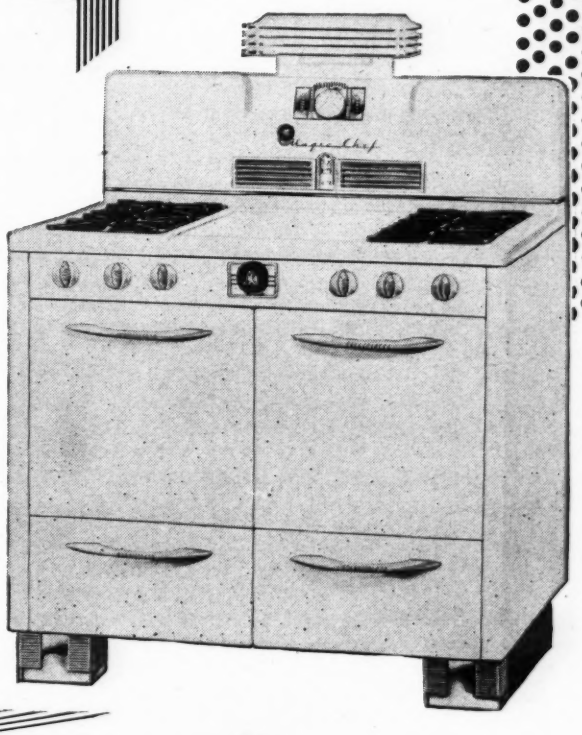
Than on any Other Range

★National (impartial) surveys prove the overwhelming popularity of Magic Chef. This nation wide consumer acceptance can be attributed to Magic Chef leadership in giving their dealers the finest range available backed by 26 years of the strongest national advertising program in the gas range industry. The end result—Magic Chef is the easiest range of all to sell.



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The **EASIEST** *Range of all* **TO SELL** *!*

PIPE LINE NEWS

• Application for a permit to build a gas transmission line in Prairie Grove, Washington county, Ark., has been filed with the Arkansas Public Service Commission by the **Arkansas Western Gas Co.** of Fayetteville. Construction cost is estimated at $69,000.

• Work is well advanced on the $1.5 million pipe line project started last spring by **Northwestern Utilities, Ltd.,** Edmonton, to serve a number of towns in central Alberta with natural gas. Approximately 1000 residents of Camrose attended ceremonies which ushered in the arrival of natural gas. Julian Garrett, vice president and general manager of Northwestern Utilities, was present at Camrose and at a similar ceremony at Wetaskiwin.

• Permission has been obtained by officials of **United Gas Pipe Line Co.,** Shreveport, La., to cross county and state highways where necessary during the construction of a pipe line through Escambia county, Fla. The line will serve the communities of Atmore, Bay Minette and Brewton, Ala., and will make gas service available for potential development in several small Florida towns.

• **Northern Natural Gas Co.,** Omaha, Nebr., has applied to the FPC for authority to make extensive additions to its pipe line system running from Texas through Oklahoma, Kansas, Nebraska, Iowa, Minnesota and South Dakota. Cost is estimated at $12,667,600. The company plans to increase capacity of its line north of Clifton, Kan., from 325 MMcf to 407 MMcf daily to meet anticipated needs for this winter. In addition, Northern Natural proposes to serve natural gas at wholesale for distribution in St. Paul, West St. Paul and South St. Paul, Minn., and in Marshalltown, State Center and Colo, Iowa.

• **Chicago District Pipeline Co.,** Joliet, Ill., has filed an application with the FPC requesting authorization to construct facilities to enable it to receive increased deliveries of gas from **Natural Gas Pipeline Co. of America.** Such facilities would increase capacity of Chicago District's Crawford line from 220 MMcf to 315 MMcf per day. Construction proposed consists of a 24-in. line paralleling 11.6 miles of the Crawford line.

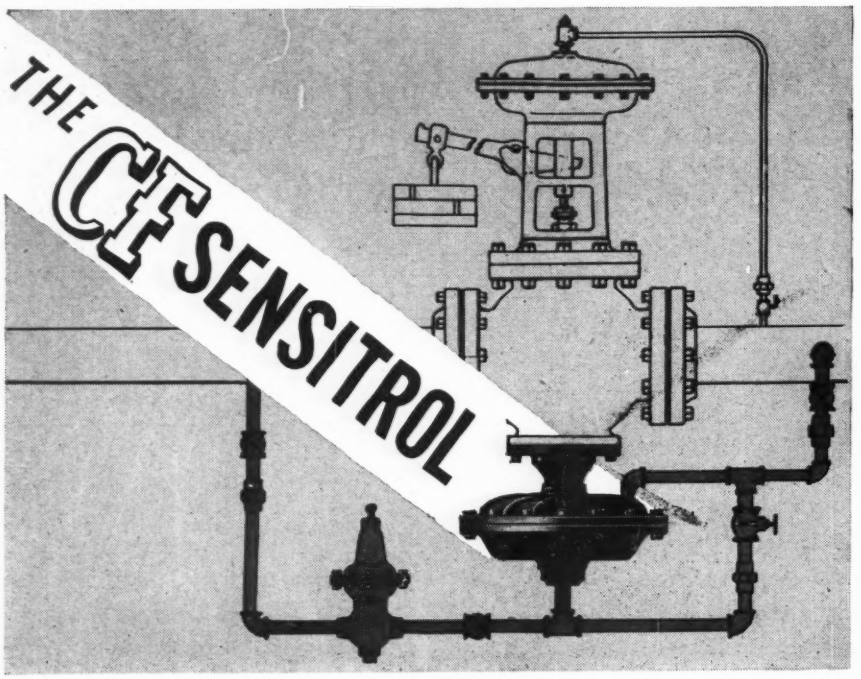
The necessary funds, estimated at $750,000, will be furnished by **Peoples Gas Light and Coke Co.,** owner of Chicago District.

• **Michigan-Wisconsin Pipe Line Co.** has estimated that its maximum daily delivery of natural gas to Detroit in 1948, if its proposed $84 million line from Texas and Oklahoma is completed then, will be 92.9 MMcf. This would be in addition to the maximum daily delivery of 125 MMcf which **Michigan Consolidated Gas Co.,** the distributing company in Detroit, may receive under its present contract with **Panhandle Eastern Pipe Line Co.**

• The FPC has set a hearing for Sept. 18 on an application filed by **Reynosa Pipe Line Co.,** Corpus Christi, Texas, for authority to construct a 30-mile, 12-in. pipe line to export natural gas to Mexico for delivery to **Gas Industrial de Monterrey, S. A.** This filing was a condition of a June 6 FPC order authorizing Reynosa to sell and deliver up to 50 MMcf daily to the Mexican firm at the international border.

• **Natural Gas Pipeline Co. of America** and **Texoma Natural Gas Co.,** both of Chicago, have applied to FPC for permission to extend and enlarge their combined transportation system from which Natural distributes gas at wholesale in Kansas, Nebraska, Iowa, Illinois and Wisconsin. Facilities requested would increase delivery capacity of the system from 349 to 484 MMcf per day.

• **Pacific Pipe Line Construction Co.,** Los Angeles, has been awarded a contract to construct a $900,000 line from Pittsburg, Calif., near San Francisco, to the Suisun Bay, Kirby Hill, and West Rio Vista gas fields. The line, which will have a daily capacity of 65 MMcf, is being built for **Pacific Public Service** and will be completed this year.



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PILOT-LOADING CONTROL for High and Low Pressures

An auxiliary pilot-loading mechanism for use with a weight-loaded gas regulator in controlling high, medium, or low outlet pressures.
Easy installation, more accurate regulation, increased usable capacity, uninterrupted service, operation on lower line pressures to reduce leakage, bleed into the outlet — not the atmosphere — at all times. Can be attached to a regulator already in use, with no other change. For new installations, furnished with a regulator of correct type and size.

SENSITROL is of rugged construction, trouble-free in service. Write for Bulletin 150.

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THE CHAPLIN-FULTON MFG. CO.
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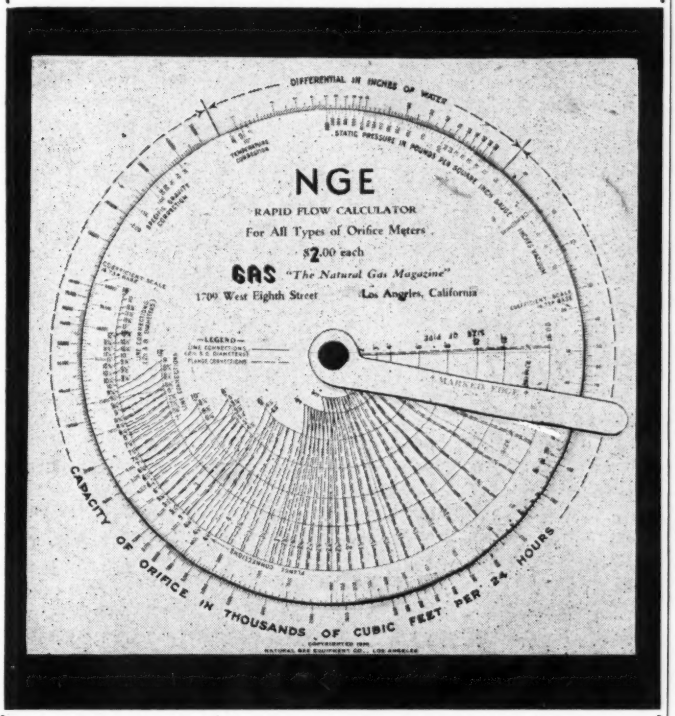
FROM 2 inches TO 16 inches


DIFFERENTIAL IN INCHES OF WATER
STATIC PRESSURE IN POUNDS PER SQUARE INCH GAUGE
NGE
RAPID FLOW CALCULATOR
For All Types of Orifice Meters
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CAPACITY OF ORIFICE IN THOUSANDS OF CUBIC FEET PER 24 HOURS

. . . will quickly compute any of a series of variables in the transmission of natural gases.

SIMPLE to operate: Set dial . . . Turn indicator . . . *and instantly find*

1 COEFFICIENT and VOLUME
2 CORRECT ORIFICE SIZE IN ANY GIVEN VOLUME
3 DIFFERENTIAL PRESSURES

Our NGE CALCULATOR has been tested in field and desk use. Why not let it *help you* with your daily problems. If interested send in coupon and you will receive our calculator in a few days.

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$2.00 EACH
25% discount on all orders for 25 or more

Gentlemen: Please send me.....NGE *Gas Flow Orifice Calculators* for which I am enclosing my check or money order for $..... *Add 2½% sales tax in California.*

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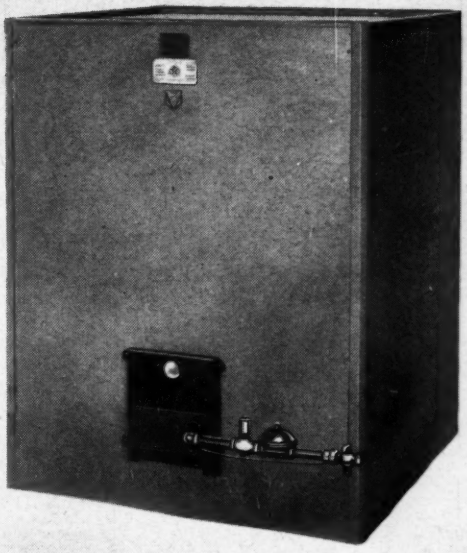
Another Member of the Hammel *Line*



GRAVITY FURNACE

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An abundance of warmth *when* you want it—*where* you want it, is provided by Hammel's highly economical Gravity Furnace.

Because of their extreme simplicity they are adaptable to a wide range of uses in modern heating. These furnaces are extremely popular for residential and commercial buildings. Hammel Gravity Furnaces are clean and quiet in operation; they add to the appearance of any basement. May be equipped with your choice of standard controls.

Write or phone for complete information on any heating unit in the Hammel line—there's one available for every heating need.

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Successors to Hammel Radiator Corp.
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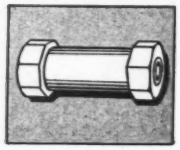
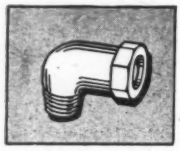
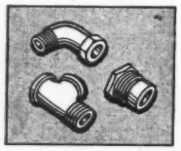
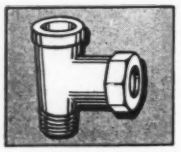
for maximum deflection, ease of "stabbing," complete confinement of the rubber!









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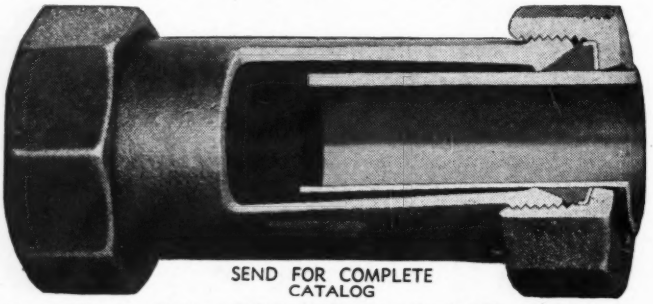

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STREET CITY ZONE STATE

Steps Taken to Augment Ontario Natural Gas Supply

At a conference of industrialists and Ontario government officials in Toronto on Aug. 20, it was decided to continue an arrangement which had been in effect for two years whereby stocks of liquid propane are diverted to the Dominion Natural Gas Co. to bolster that company's dwindling natural gas supply.

Hon. Dana Porter, minister of planning and development, said that the gradual depletion of the natural gas fields in Southwestern Ontario has been of grave concern to the provincial government for some time, and that although existing sources of supply are being depleted steadily, no major discoveries have been made recently. As a result, the supply of gas from Ontario sources has not been adequate to meet the demand. The minister urged conservation of gas in every possible way.

Hoosier Gas Corp. Buys Knox Utility Corp.

E. J. Meade, president of the Hoosier Gas Corp., Vincennes, Ind., has announced his company's purchase of the assets of Knox Utility Corp., as well as transmission lines and gas wells owned by the Mid-West Developments Corp. and J. E. Bauer, which now serve Knox Utility.

While the added wells and transmission lines will facilitate better service throughout Hoosier's area, which originally consisted of Knox, Daviess and Gibson counties, the lines and wells in parts of Pike and Martin counties were needed to expand service through a desired section of the state.

The town of Loogootee, which has been dependent upon gas wells in its immediate vicinity, is now assured a substantial supply of gas.

Average Cost of Drilling Shows Decided Increase

In the August issue of the Department of Commerce publication, "Domestic Commerce," David L. Siskind reported that the average cost of drilling an oil or gas well in the United States rose from $16,529 in 1939 to $29,217 in 1945, an increase of 76.76% in seven years. The report was based on an analysis of construction cost data compiled by the Census Bureau. This analysis indicated that drilling industry capital expenditures were $455,386,000 in 1939 and $741,071,000 in 1945.

Siskind stated that few drilling cost figures are available because the industry paid little attention to costs until wartime price control was inaugurated.

Honeywell has New Location

The Los Angeles branch of Minneapolis-Honeywell Regulator Co. has moved into new and larger quarters at 2840 East Olympic Blvd. G. S. Younkin, manager, explains that in 1946 the company consolidated all of its activities into one headquarters for commercial and air conditioning controls, heating controls, aeronautical controls, and industrial instruments. These accumulated facilities, plus new staff members, necessitated the move.

Pressure Weld Co. Moves From Houston to El Paso

The Pressure Weld Co. of Houston, Texas, has announced the removal of its office from 421 Niels Esperson Bldg. to the 8th floor, El Paso National Bank Bldg., El Paso, Texas. The office is under the management of E. P. Jones.

The move to El Paso of the personnel and equipment of the company will facilitate its share of the operations on the El Paso Natural Gas Co. pipe line from west Texas to California.

Rate Hearing Postponed

The Federal Power Commission has postponed until Oct. 14 a hearing on the reasonableness and adequacy of terms of service in present rate schedules of Panhandle Eastern Pipe Line Co. The hearing, which was originally set for Sept. 16, will be held in Washington, D. C.

GAS PRODUCTION

• Oil and gas exploration in unproven territory in Mississippi has been gaining steadily, bringing the total of wildcat tests to 24, according to a recent report. Three of the permits were for sulphur tests in Lawrence county to be made by the **Sippiala Corp.**, Houston, Texas. Some of the more recent permits were for tests scheduled by the **A. W. Hutchings Drilling Co.** in Warren county, and by **Burns & Miller** in Isaquena county.

• **Economic Stabilizer John R. Steelman** has announced a reduction in stripper oil well subsidies which, he said, will save the government about $2.5 million monthly. Effective retroactive to Aug. 1, the plan calls for a reduction of subsidies of 25 cents per bbl. This is the amount by which stripper well producers have benefited by price increases since crude petroleum was removed from price control.

• A slight gas blow indicating presence of gas and possibly oil has developed during testing at the **Atlantic Refining Co.'s** Big Point area wildcat exploration in Lake Pontchartrain, La. Two tests for production have been made, the first with perforations shot in the pipe at 9238-77 ft., which gave no shows. The second test was made at 8440-90 ft. to give the blow.

• The discovery of a new deep gas-distillate area in Brooks county, Texas, appeared certain recently on the basis of a second show for such production at **Sun Oil Co.** No. 6 Sullivan, Loma Blanca grant. The hole tested a flow of 65 bbls. of distillate daily on 3/16-in. choke during tests in perforated sand at 10,305 to 10,388 ft.

• In a recent weekly oil report the **Louisiana State Conservation Department** announced the completion of 12 new wells with initial daily productions totaling approximately 1900 bbls., the abandonment of 16 tests and the issuance of 44 permits for new wells.

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Yes, you can actually make larger profits from small city gas plants. How? By converting to Liquefied Petroleum Gas.

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Warren's broad experience, engineering advice and consulting service are available without obligation.

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Catalogs

● **Amercoat Division, American Pipe & Construction Co., P.O. Box 3428, Terminal Annex, Los Angeles 54, Calif.**—This 8-page technical bulletin, a protective coating comparison chart, recommends Amercoat applications for solving problems of members of the bottling and dairy, brewing, chemical, food, marine, paper, petroleum, photographic, plating, public works, sewage and water works, textile and synthetic fibre manufacturing, transportation, wine and distilling industries. The chart shows characteristics and properties of Amercoat plastic coatings and is a guide for selecting the proper coating, preparation of surface, and application methods on steel, concrete and wood. The cost per square foot for materials, with area formulae, is provided. Free upon request.

● **Victor Equipment Co., 844-54 Folsom St., San Francisco, Calif.**—This 102-page, two-color book, "G-E Arc Welding Electrodes," has been prepared by General Electric Co. The eight sections of the book discuss the following topics: how welding electrodes are made; tentative specifications of the AWS and ASTM; handy color guide for quick identification of G-E electrodes; how to select electrodes; ready-reference chart for selection of G-E electrodes; description of G-E electrodes; operating data; and engineering data.

● **Springfield Boiler Co., 1919 E. Capitol Ave., Springfield, Ill.**—Bulletin No. 746 describes the Springfield Type M series of standardized boilers. Advantages of this particular series are listed as the following: self-supporting construction, simplified erection, standard dimensions, choice of 12 capacities, choice of firing, and low engineering costs and quicker delivery. The bulletin includes a measurements and data table to aid in selecting the proper boiler for specific requirements.

● **E. D. Bullard Co., 275 Eighth St., San Francisco 3, Calif.**—This firm has issued a 106-page catalog and safety manual of postwar items of industrial safety. The book is divided into seven sections: eye protection; welders' safety; gas, dust and fume protection; first aid; hats, belts and clothing; miscellaneous safety equipment; lamps and lanterns. It is available through the company.

● **Bendix Home Appliances, Inc., South Bend, Ind.**—"How to Plan a Modern Labor-Saving Home Laundry" is a new catalog prepared by the Bendix Home Laundry Institute. It contains plans for laundries required in many sizes and types of homes, practical laundering hints, and a discussion of how the institute can be of service to the housewife.

● **Bailey Meter Co., Cleveland 10, Ohio**—Bulletin No. 17 describes process controllers, control components, measuring components and instrument combinations. Application data such as sizes, pressure standards and ranges are listed for the various components. Typical control systems of both the single and multiple element type are illustrated.

• **Surface Combustion Corp, Toledo 1, Ohio**—Bulletin SC-129 describes the why, what and how of prepared atmospheres, the nature of the constituents of the various atmospheres, the effect of each and the combinations used. A two-page table shows the numerous applications of the atmosphere in such heat treating operations as carburizing, carbon restoration or "skin recovery" of surface-depleted steels, dry cyaniding, bright annealing of stainless steels and others.

• **The C. M. Kemp Mfg. Co., Baltimore, Md.**—Bulletin No. 1E-10, Gas-Fired Immersion Melting for Stereotyping and Electrotyping, contains 19 photographs and diagrams and gives dimensions, consumption, plate melting rates, capacities, and shipping weights. There is a buyer's check list for selecting equipment, and an analysis of current melting methods and their relative performances. Stereotype, electrotype, remelt, and job installations are covered.

Ventura Plant Additions To Boost Goleta Gas

Executive Engineer Fred Hough, Southern Counties Gas Co., Los Angeles, has announced that a contract has been awarded to build an addition to the company's Ventura compressor plant, and work has begun on the job. Plans for the Ventura addition, designed to increase deliveries from the La Goleta dry gas field to Los Angeles during peak day demand periods, call for an expenditure of over $800,000.

Three new compressor units, housed in an extension to the present building at the plant, will be installed, providing a total of 3000 hp. In addition, 3400 hp will be converted from field gas compression to booster service, increasing delivery capacity by 1½ MMcf per hr.

It is expected that the plant will be ready for the 1946-47 winter season.

"Hot Water Magic" Published by A.G.A.

The American Gas Association, as an initial step in promoting the sale of automatic gas water heaters by focussing national attention on the importance of high water temperatures to comfortable living, has published a three-color brochure entitled "Hot Water Magic."

The booklet was produced in two editions, one for the use of colleges and schools, and the other for distribution to customers of local gas companies. The consumer booklet carries a heavier sales emphasis on gas water heaters and gas clothes driers.

Birmingham Homes To Receive Natural Gas

The Birmingham Gas Co., Birmingham, Ala., has announced that it is supplying natural gas to domestic consumers for the first time. Charles G. Gamble, president of the utility, said about 3200 consumers in the Over-the-Mountain Shades Valley residential section have changed from industrial by-product gas to natural gas.

A number of industrial firms in the city use natural gas in their operations, but this move marks the first time it has been supplied to domestic users. The gas is being piped from Louisiana fields.

Hidden Leakage Means Hidden Loss

prevent it three ways with "Carboseal" Anti-Leak

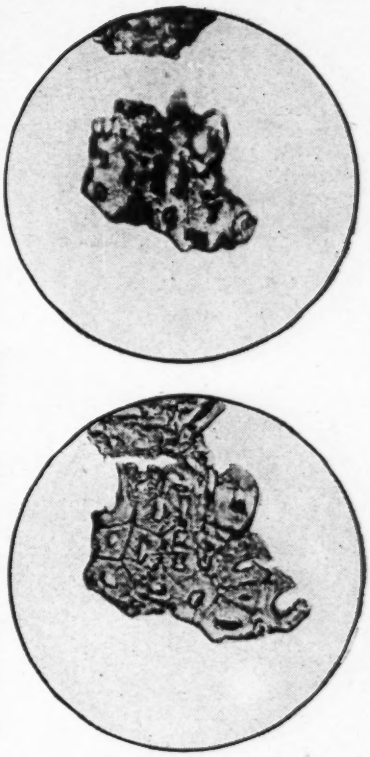
"Carboseal" anti-leak is a specially developed compound which works *three ways* to cut losses in dry-gas distribution systems:

It efficiently and economically swells the jute fibers in bell-and-spigot joints and makes them gas-tight—cuts hidden losses of gas up to 100 per cent.

Rust and dirt in mains is saturated and kept in place by the "Carboseal" treatment — thus eliminating many service calls due to pilot outages.

"Carboseal" contains an inhibitor which cuts down maintenance costs due to corrosion.

A 20-page booklet tells more about "Carboseal" anti-leak treatment—how it is applied, what equipment is needed, how much typical treatments cost, and the results that can be obtained. A copy of this book is yours for the asking.



The photomicrographs above illustrate the tremendous increase in volume when dried-out jute fibers are treated with "Carboseal" anti-leak. The photograph at top shows a cross section of dry jute fiber—the photo at bottom shows the same fiber after treatment with "Carboseal" anti-leak. The fiber has increased 44 per cent in volume and will maintain that volume indefinitely. "Carboseal" anti-leak will do the same for the jute packing in bell-and-spigot joints in your dry-gas system.

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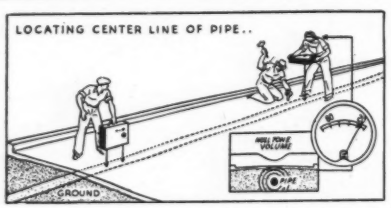

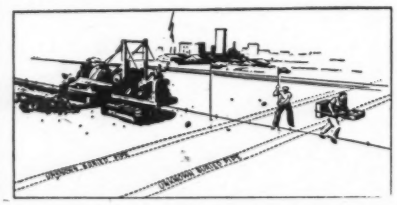

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FISHER RESEARCH LABORATORY
Palo Alto, California

Norwalk Valve Co. Buys Iron Sponge & Governor Co.

The Connelly Iron Sponge & Governor Co. has sold its regulator, check valve and apparatus business, including all inventory, equipment and patents, to Norwalk Valve Co., South Norwalk, Conn.

Andrew Dolfini, in charge of valve and governor manufacturing for Connelly for many years, has been production manager for Norwalk Valve Co. for the past three years and will continue in charge of production. G. A. Anderson will be in charge of engineering and sales. He is a chemical engineer and was superintendent of the gas department for Wisconsin Public Service Corp., Sheboygan, Wis., from 1922 to 1945. W. L. Lyon, president, Gas Consumers Association, will be general manager.

Norwalk Valve Co., which was operated for a short time as a division of Allied Control Valve Co., has returned to its original owners and is now operated by Gas Consumers Association.

90% of New Housing Using Gas for Heating

The Brooklyn Union Gas Co., Brooklyn, N.Y., reports that since the beginning of the year construction has been started on 75 new housing projects in its territory. Plans for the thousand-odd one- and two-family houses include specifications for modern gas service. All are being equipped for gas cooking, many for gas refrigeration, and over 90% for gas space heating and water heating.

In order to supply gas service to a number of these housing developments it was necessary to extend existing mains for considerable distances in some cases. Consumption of gas in the new dwellings is estimated at 277 Mcf per house annually.

St. Louis Firm Emphasizes Public Utility Relations

Fleishman, Hillard & Associates is a new St. Louis firm which will include as one of its specialties the study of public relations problems in privately-owned utilities. Alfred Fleishman, who heads the organization, points out that an over-all survey of the field indicates growing pressures for municipal ownership of utilities, and that utilities must adopt a sound public relations program which will get across to all groups—employees, stockholders and the general public—the advantages of private ownership.

Stacey Dresser to Install Albany Propane-Air Plant

A contract has been awarded to Stacey Dresser Engineering of Cleveland, Ohio, division of Stacey Brothers Gas Construction Co. of Cincinnati, for the design and installation of a propane-air gas plant at Albany, Ga. The plant will produce 312 Mcf daily of 550 Btu propane-air gas and is designed at other lower capacities to meet variable peak winter load requirements.

Complete unloading and liquefied propane storage facilities will be provided, and the generating equipment will include a Btu recorder and controller.

Westinghouse Sterilamp Sterilizes Refrigerators

Westinghouse Lamp Division has announced development of an ultraviolet light to provide electronic sanitation in home refrigerators for a nickel a month. The midget sterilamp is the size of an automobile headlight bulb and screwed into a niche of the refrigerator cabinet's interior, simultaneously pours forth a barrage of bacteria-killing rays and produces ozone in the cabinet's air.

The bactericidal radiation and ozone wave lengths emitted by this lamp assure odorless refrigerators, improve sanitation, enable longer preservation of food and check the growth of mold and bacteria on food. A transformer, required to step down household electric voltage to the 12-volt lamp, consumes only 3½ watts, the announcement said.

Natural Gas Service In Canada Expanded

Approval has been granted by Athabasca, Alberta, a town located 100 miles north of Edmonton, for a 20-year gas franchise. Gas will be delivered from Deca No. 2, a 15-MMcf-per-day gas well. Charles F. Withers and Walter F. Thorne, independent operators of Lloydminster on the Alberta and Saskatchewan border, submitted the plan to the Athabasca town council and secured the franchise. Gas service is continually expanding in Alberta and about 20 new towns will be receiving it this winter.

In Saskatchewan, only 1% of the population has natural gas, although substantial reserves have been discovered around Unity, and a real effort toward expansion in that province is now in progress.

Peabody Engineering Expands Stamford Plant

The Peabody Engineering Corp., 580 Fifth Ave., New York City, has announced that construction of additional plant facilities is now in progress at its works in Stamford, Conn.

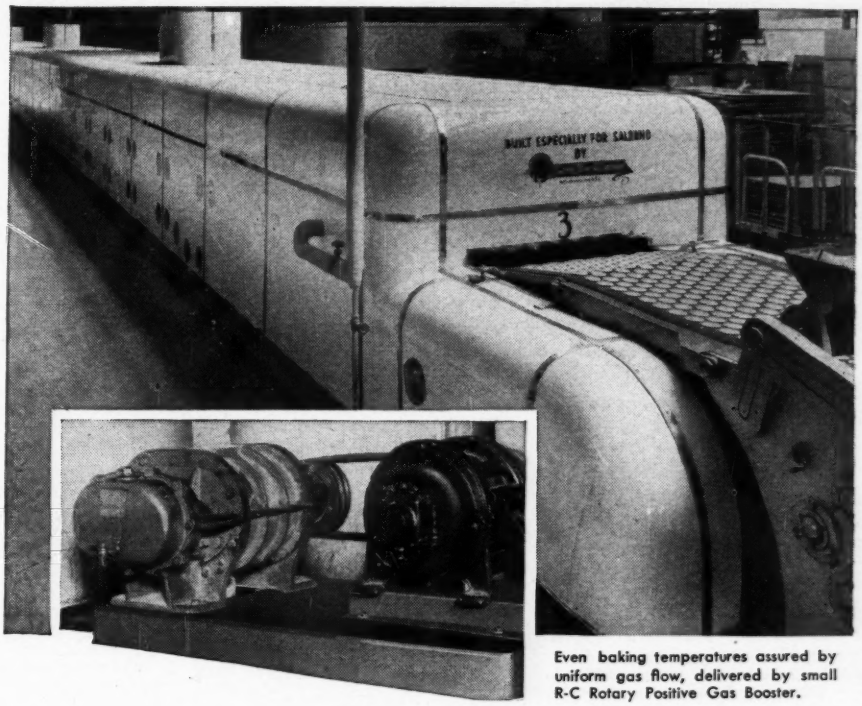
This construction is part of a long-range expansion program, and it will be used primarily as a plate and welding shop, and for the assembly of bulky or heavy fabricated products such as air heater or gas scrubber shells and completely prefabricated fuel oil pumping and heating units.

Emphasis has been placed on the comfort and safety of the workers. Modern tools, material-handling equipment, and lighting will make the plant an ideal place in which to work. The building has been designed especially so that additions can be made rapidly without disrupting manufacturing.

Union Light Heat & Power Starts $399,000 Building

Ground was broken recently for a new service building in Covington, Ky., which will be constructed by Union Light, Heat & Power Co. at a cost of $399,000. The building will house operations of the electric and gas departments and will contain a warehouse, offices for both departments, a large gas pipe storage area, garage and garage shop and electric pole yard.

Contractor in charge of erecting the three-section brick structure is the Carl H. Rauch Building Construction Co.



Even baking temperatures assured by uniform gas flow, delivered by small R-C Rotary Positive Gas Booster.

COOKIES, CHEMICALS, OR CASTINGS..

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No small valves, vanes or parts in the simple R-C Rotary Positive units—successfully used for almost a century of industrial progress.

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R-C Centrifugal Blowers offer an extensive choice of proved modern designs, where this type is better adapted to any specific application.

Uneven flow of fuel or air in industrial heating processes causes varying temperatures, inferior production quality. That's costly, whether you're processing foods, plastics, metals or textiles.

Roots-Connersville Rotary Positive Blowers and Gas Pumps have a long record of success in such applications. With only two moving parts, their simple, sturdy construction assures long-time, trouble-free performance.

Or, if Centrifugal Blowers or Exhausters meet your needs better, you'll enjoy similar full satisfaction from the advanced engineering built into this type of R-C units. We're unbiased in our recommendations because we build both types equally well. That's what we mean by R-C *dual-ability*.

We'll help you select standard R-C equipment of any capacity, or design special units to match your needs. Consult us without obligation.

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BLOWERS FOR EVERY NEED

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A Semi-Automatic Process

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FOR ALL GAS APPLIANCES

A. G. A. APPROVED

H-M Low Pressure Gas Regulator
Sizes from 3/8 in. to 1½ in.

The "H-M" low pressure regulator is readily adaptable to practically every type and size of household or domestic appliance. It is designed to insure accurate performance under all field conditions with practically trouble-free operation.

"H-M" Regulators are ruggedly built of high quality aluminum; are extremely light in weight to facilitate handling and to provide for low shipping cost. The sturdy construction will withstand much more than ordinary abuse. Body and cover castings and all internal parts are of corrosion-resistant materials.

Each and every "H-M" Regulator is factory tested, adjusted and sealed to the customer's individual specification.

THERMAC COMPANY

800 EAST 108 ST. • LOS ANGELES 2, CALIF.

Water Heater Men Urge Use of Sizing Charts

One hundred executives and salesmen of Southern California Water Heater Manufacturers and of Eastern factories with local distribution met Sept. 4 in Los Angeles to revive interest in the promotional campaign of the PCGA Water Heater Council.

Claude Ballinger, co-chairman of the council, presided. Principal speakers were Clyde H. Potter, chairman of the Water Heater council, and R. V. Davis of the A. O. Smith Corp. Potter reviewed the history of the council, the need for developing a sizing chart (GAS, Nov., 1945, p. 26), and appealed to the manufacturers to carry the story to every water heater dealer, plumber and outlet in Southern California. R. V. Davis outlined in detail the basis of the chart, how it should be used, and appealed to all manufacturers to purchase a stock of sizing charts for the use of their salesmen.

South Atlantic Gas Co. Building $50,000 Plant

A $50,000 gas producing plant is being constructed at DeLand, Fla., according to R. D. Timson, manager of the DeLand South Atlantic Gas Co. office. The new plant will include three buildings and two 30,000-gal. storage tanks.

When the plant is completed, DeLand will receive its gas supply locally instead of by pipe line. The gas to be produced will necessitate slight changes on all gas appliances in the city. These changes will be made by the company at no cost to consumers and without interruption of service.

Tube Turns Announces Line of Welding Fittings

One of the most complete lines of stainless steel welding fittings to reach the postwar market is being manufactured by Tube Turns, Inc., Louisville, Ky., according to Jack Green, sales manager of the welding fittings division. Green states that surveys conducted by the firm's engineering service department and other research groups indicate that the fittings, which are available in three grades of stainless steel, meet 95% of industry's standard requirements.

East Ohio Rehearing Set; Granted Stay of FPC Order

The East Ohio Gas Co., Cleveland, Ohio, has been granted limited rehearing on Oct. 23 of a recent FPC order. A stay of the June 25 order in which East Ohio was found to be a natural gas company within the meaning of the Natural Gas act and therefore subject to FPC jurisdiction with respect to provisions of the act, accompanied the commission's order for a rehearing.

Cities Service Gas Co. To Move to Wichita

The Cities Service Gas Co. will remove its operating headquarters from Bartlesville, Okla., to Wichita, Kan., on or before March 1, according to S. B. Irelan, president.

An agreement for necessary office space has been signed, making possible a move which was planned two years ago.